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THE VIRGIN RANGE

AND

THE WHITE MAN'S TOLL

FROM

THE WESTERN RANGE—A GREAT
BUT NEGLECTED NATURAL RESOURCE

FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE



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II. THE VIRGIN RANGE

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The transcontinental traveler of today would have difficulty in visualizing the western range as it was before occupancy by the white man and his domestic livestock, for little virgin range remains in the western United States. But nearly a century ago the "forty-niner", on his way overland to the Pacific coast, found a vast, unspoiled natural reservoir of forage extending from the Mississippi River to the Pacific Ocean and from Canada to Mexico. Much of it was called at that time the "Great American Desert"—an immense region of rolling grassland, parched deserts, and rugged mountains; inhabited only by Indians and roving herds of buffalo, elk, and other animals; with treacherous rivers to be forded and long stretches without water of any kind, with mud or dust, blistering heat or sudden snowstorms. Who among these overland voyagers could have dreamed that within a few short decades other settlers would engage in fierce wars among themselves for possession of this "desert" land; how could they have guessed that this land would produce five times more wealth for the Nation through the pasturage of livestock than all the gold they would dig out of the earth with their picks and shovels? For this vast desert, plain, and mountain country was soon to become the great western range.

Before agricultural settlement by the white man, the virgin range comprised the western two-thirds of the United States. If nongrazable lands such as mountain tops, almost barren deserts and dense forests, are excluded, it encompassed nearly 850 million acres. As might be expected for so large an area, there were tremendous variations in topography, soil, and climate. These great differences in environment resulted in correspondingly great differences in the kind of vegetation. In some places the range was a natural grassland that stretched for mile upon mile without bush or tree to break the monotony of the landscape. Other areas, less extensive, were brushy, the intermingled grasses and weeds being inconspicuous though present in considerable quantities. Elsewhere the range was clothed with forests, but frequently these forests were sufficiently open to permit the establishment of shrubs, grass, and herbaceous plants beneath the forest canopy.

Each of these three main classes of vegetation—grasslands, brush, and forests—included several distinctive types, areas characteristically possessing one or more outstanding vegetational features which caught the eye and lingered in the memory of the early-day transcontinental travelers. Their diaries describe how in journeying westward they spent weeks crossing first the tall-grass prairies and then the short-grass plains, "endless" grasslands extending to the very foot of the Rocky Mountains (fig. 25, p. 85). Those who traveled

the Oregon Trail encountered bunchgrass plains in what is now eastern Oregon and Washington, and those who reached the central valley of California saw a similar type. Pioneers who traveled far to the Southwest found near the Mexican border another type, the semidesert grass.

The overland travelers eventually were obliged to leave the open, grassy plains for the more laborious passage through the brush of deserts, foothills, and lower mountain slopes. Along the northern trails this type was sagebrush in which there was considerable grass; in the far Southwest was a quite different type consisting of various southern desert shrubs, such as the creosotebush and saltbushes (fig. 30, p. 95). In southwestern Wyoming, Utah, Nevada, and the Southwest the pioneers encountered salt-desert shrubs on alkaline soils, and in California these adventurers of covered-wagon days found chaparral, a dense mixture of a hundred different brush and tree species forming almost impenetrable thickets on the foothills.

On the mountain sides above the brush fields were open forests of gnarled piñon and juniper (fig. 34, p. 101). At still higher elevations, or where the soil was more moist, they encountered parklike open forests of ponderosa pine and of aspen and fir. Denser forests of spruce and fir, western white pine, redwood, Douglas fir, spruce, hemlock, and lodgepole pine occurred over large areas but intermingled with these forests were open, grassy meadows of varying size.

A DETAILED PICTURE OF VIRGIN RANGE TYPES

This varied succession of range types was found widely scattered throughout the West, often extending without a break over large areas. Other types were local only. The descriptions of the individual types which follow give a more detailed picture of the many different kinds of grazing lands found in the virgin range. The approximate total acreage³ and grazing capacity of each range type in its virgin condition are given in the next chapter.

TALL GRASS

Probably no part of the western range produced palatable and nutritious forage in such abundance as the tall-grass prairies. Not only was there an enormous volume of vegetation on the 42 million acres in this type,⁴ but there was scarcely a grass, weed, or shrub present which could not be eaten by grazing animals. When the white man first settled in the Midwest, the prairie extended wedge-like from Illinois northwesterly into Canada and southwesterly into Texas. Its western boundary, though very irregular, was in the Dakotas, Nebraska, Kansas, and Oklahoma, where the tall grass of the prairies gradually merged with the short grass of the plains.

The vegetation of the prairies varied with topography, soil, and moisture, but always dominating these gently rolling lands was a mixture of several species of tall grass. An intermingling of half-

³ Areas of range types in their virgin condition are approximations based on estimates by skilled observers and tempered by reasonably accurate information on extent of the types 50 to 100 years ago, their recent expansions and contractions and the area in each type which has been used for agricultural crops, roads, etc.

⁴ This was the area of tall grass within the limits of the present range, west of the boundary shown in fig. 25, p. 85. East of this boundary, the prairie tall-grass type covered approximately 210 million acres, or a total of about 252 million acres.

shrubs and multitudinous flowers gave the landscape variety and color. In the moist bottom lands sloughgrass grew tall as a horse's back. On the drier slopes other grasses, 2 or 3 feet tall, such as the bluejoint turkeyfoot ("big bluestem"), the prairie beardgrass ("little bluestem"), Indian grass, wild-rye, and switchgrass formed societies, characteristic in themselves, but all a part of the greater formation that was the prairie. The still drier uplands were carpeted with shorter grasses, bluestem, needlegrasses, side-oats grama, and in some places by the bunch-forming sand dropseed. Interspersed with these were semiwoody and herbaceous plants that bloomed with the change of season: goldenrods, wild daisies, the wreath aster, and a host of associates. The silvery canescence of the leadplant or "prairie shoestring", the bright yellow of the sunflower, the white of the anemone, and the brilliant orange of the butterflyweed, or "pleurisy-root", intermingled with the green background of the prairie grasses in a beautiful and intricate mosaic. In late summer these bright colors slowly faded as the vegetation dried and the prairie became a vast sea of rusty brown.

The prairie was productive. It is hard to picture today the vast numbers of wild fowl—golden plovers, prairie chickens, geese, and ducks—that inhabited this region. Countless bison grazed in massive herds over the country where later the settler was to find good pasturage for his livestock. Its vastness, its productivity, and the ease with which it restored itself all contributed toward making the prairie an exceedingly valuable range resource.

SHORT GRASS

As the pioneer moved westward the tall-grass prairies gradually gave way to an endless carpet of sod-forming grasses much shorter than those of the prairies. These vast short-grass plains were for the most part fairly level and extended from the Panhandle of Texas northward beyond the Canadian border. The eastern edge was near the center of the present States of Kansas, Nebraska, and the Dakotas; westward it stretched to the very foothills of the Rocky Mountains, forming a belt from 300 to 600 miles wide and 280 million acres in extent.

The plains country received very much less rain than the prairies, and, as a consequence, was dominated by grama and buffalo grass, which needed relatively little water. The deeper-rooted, moisture-requiring tall grasses and herbs so typical of the prairies were almost entirely excluded.

This vast area of sod-grasses was not, however, uniform in composition throughout its entire extent. Along the western edge of the short-grass belt in Montana and Wyoming, the short-grass type alternated with the sagebrush and was further modified by a generous admixture of several other valuable forage plants including wheatgrass and junegrass. Further south, along the western edge of the short-grass plains, the grama was mixed with a great variety of palatable herbaceous plants, some of which also were found in the nearby mountains. In what is now western Kansas and Oklahoma, eastern Colorado, northeastern New Mexico, and the Texas Panhandle, buffalo grass, galleta grass, and other grasses appeared in greater abundance than in the more northerly portions of the type

Various annuals of moderate or low palatability also appeared: Woolly Indian-wheat, sixweeks fescue, rough pennyroyal, and western stickseed; and during wet years, perennial grasses such as needle-and-thread and sand dropseed, together with various weeds, developed a taller cover. Elsewhere, bluestem ("western wheatgrass") and western needlegrass added greatly to the luxuriant appearance of the short-grass cover. In the transition zone between the prairies and the plains, the sod cover was more open, and included deep-rooted plants of the tall-grass type such as "wiregrass" and bush morning-glory.

Grama, buffalo grass, and most of the other species of the short-grass type were palatable and nutritious. Although the short grasses matured early, their cured leaves remained as valuable forage and were available the year round except when covered with snow. Injurious species were at a minimum. The high grazing capacity of the range is indicated by the enormous herds of buffalo which roamed these plains.

PACIFIC BUNCHGRASS

In western Montana, southwestern Idaho, eastern Washington and Oregon, and in central California the pioneer found a luxuriant grassland that resembled the prairies but with the additional characteristic of many grasses growing in tufts or bunches. This bunchgrass type was so luxuriant in its virgin condition that explorers made frequent comments concerning it. Commander Wilkes (186)⁵ wrote in 1841 of north central Oregon: "These hills, as well as the country nearer at hand, were covered with a natural hay or bunchgrass, which affords very nutritious food for cattle", and again near Walla Walla in eastern Washington, "To the north and south are extensive prairies, covered with the natural hay of the country, on which the cattle feed." Frémont (55) wrote of eastern Oregon in 1843: "The mountains were covered with good bunchgrass"; and later Stuart (138) recorded:

We crossed the Rocky Mountain Divide on the 10th day of October, 1857, where the station called Monida now is on the Oregon Short Line railroad. As soon as we had crossed the divide a wonderful change appeared in the country. Instead of the gray sagebrush covered plains of Snake River, we saw smooth rounded hills and sloping benchland covered with yellow bunchgrass that waved in the wind like a field of grain.

These testimonials as to the character, productivity, and palatability of the vegetation abounding in this territory are further substantiated by scattered remnants of the original vegetation, not so easily read as diaries but far more realistic. Cemeteries, fence corners, and moderately grazed fields indicate an abundance of palatable and nutritious bluebunch wheatgrass, Idaho fescue, giant wild-rye, bluegrass, and needlegrass. Not so abundant, but highly important as forage, were palatable weeds, such as balsamroot, hawksbeard, mountain-dandelion, and sunflower.

Farther south, in California, was a similar native bunchgrass prairie closely resembling the bunchgrass prairies of the Pacific Northwest. The more important forage species were bluegrass, june-

⁵ Italic numbers in parenthesis refer to literature cited, p. 557.

grass, oniongrass, needlegrass, wild-rye, and squirreltail grasses. Clements (34) describes a nearly continuous area of California needlegrass several hundred miles long which once existed there. Mixed with these more valuable grasses were clovers, lupines, sunflowers, poppies, and innumerable other herbs in infinite variety.

Although totaling only about 61 million acres and small in comparison with the tremendous area occupied by the short-grass plains, the Pacific bunchgrass type was undoubtedly the finest grassland west of the Rocky Mountains. It provided valuable forage for immense numbers of wild animals and later was to become equally valuable for pasturage of domestic livestock.

SEMITDESERT GRASS

South of the short-grass plains and paralleling the Mexican border in Texas, New Mexico, and southern Arizona occurred a discontinuous belt of arid grassland which resembled the plains to some extent. But the vegetation of these semidesert grasslands was quite different from that of the true short-grass type. In addition to the grasses, many parts of the area supported a scraggly growth of thorny shrubs and low trees. It covered approximately 93 million acres, extending over broad, flat valleys, low hills, and mesa tops and up onto the lower slopes of the mountains.

The most valuable forage plants in this type were three grasses: Rothrock ("crowfoot") grama, black grama, and curly-mesquite. In some localities Rothrock grama formed rather dense stands having the appearance of fields of short cereal, and on the lower foothills curly-mesquite occurred in sufficient density to form a sod that in many ways resembled the buffalo-grama sod of the plains. These nutritious grasses, however, though distributed widely throughout the type, comprised only a relatively small portion of its total area. More widely distributed was the black grama, which sparsely covered the sandy and gravelly slopes between the river bottoms and the foothills.

Scattered through this grass type were thorny shrubs and dwarfed trees such as mesquite, mimosa, catclaw, and other acacias, hackberries, creosotebush, jojoba, ceanothus, and low-growing live oaks. Interspersed with these were pricklypear and other cacti, yucca or Spanish-bayonet, and other plants characteristic of regions of little rainfall. None of these latter species were of appreciable value for forage.

The diaries of the early explorers and the accounts of later travelers through the Southwest seldom or never mentioned any difficulty in finding forage for their animals. The immense numbers of pack and draft animals and cattle that year after year followed the Butterfield and old Texas-California cattle trails through this type were able to maintain themselves on the natural forage during months of travel.

SAGEBRUSH-GRASS

One of the most distinctive range types which the early travelers encountered was the sagebrush-grass. The pioneers of the Oregon Trail seldom were out of the sagebrush type from the time they entered it in eastern Wyoming until they reached the Cascade Range in central Oregon; or if they turned southward in southern Idaho

they found it all the way through Nevada to the foothills of the Sierras.

The traveler, accustomed to the green prairies of the Midwest, found the dull, gray expanse of the sagebrush forbidding and barren, but in reality this type had many attractive features.

There are many lovely plants that blossom in early spring, filling the air with fragrance, and in summer and fall the yellow of sunflowers and of the still more plentiful rabbitbrush, a relative of the goldenrod, frequently give broad dashes of brilliant color. Beneath the sagebrush in a state of nature nutritious bunchgrass grows abundantly (112).

A significant feature of the virgin sagebrush type was the abundance of palatable grasses and weeds which grew under and between the shrubs. Prominent among these were the wheatgrasses, blue-bunch fescue, needlegrasses, wild-rye, Indian ricegrass, wild geranium, balsamroot, and yarrow. Of lesser importance as forage but of frequent occurrence were hawksbeard, phlox, sunflower, lupine, and many other species. This cover of grass and weeds beneath the sagebrush varied in density with soil and moisture conditions from a thin stand such as in the Snake River plains of Idaho to a fairly thick sod as in the mountains along the foothills in Montana.

Occasional very dense stands of sagebrush were found, but as a rule the individual plants were several feet apart, forming open diminutive forests from 2 to 7 feet in height. Mingled with the silvery gray foliage of the sagebrush were other browse species such as bud sagebrush ("bud-sage"), bitterbrush, and rabbitbrush.

Throughout its range the sagebrush type occurred in streaks and patches along rivers and streams as well as on areas of poorer and drier soils. It was found on extensive plains, on the rolling foothills, and extended upward on dry mountain slopes to merge with open forests of piñon-juniper and ponderosa pine.

In its primitive condition, the rich understory of grasses and weeds beneath the "sage" provided abundant feed in spring and fall for deer and other animals that migrated between plains and foothills and the higher elevations. On the broad plains, nutritious forage was available throughout the year. Because of its widespread occurrence over 90 million acres and its high forage value, the sagebrush-grass type was unquestionably one of the most important of all the original western ranges.

SOUTHERN DESERT SHRUB

Driest of all the range types was the southern desert shrub, of which the greater portion was in southwestern Arizona, southern Nevada, and southeastern California. Smaller areas occurred in southern and western Texas and southern New Mexico near the Mexican border. The Mohave Desert is included within this type as are also the lower valleys of the Rio Grande and of the Colorado, Gila, and Pecos Rivers. In its original condition only 25 of the approximately 51 million acres in this type were of appreciable value for grazing.

Owing to extremely high temperatures and very low rainfall, this type has never produced sufficient vegetation to make it a very dependable part of the range resource. Travelers, however, invariably were impressed with the bizarre and varied appearance of the plants on these sun-scorched desert lands. There was little uni-

formity in the plant cover. Gray stretches of desert saltbush formed dense thickets 3 or 4 feet tall in the valleys. Over extensive tracts, widely spaced creosotebushes gave the appearance of scrubby orchards. On the surrounding hills and ridges were varied forms of cacti, centuryplants, agaves, and yuccas; this portion of the desert must have been interesting, picturesque, and even weird with its great columnar cacti, spiny paloverdes, the radiating stems of ocotillo, and the beauty and variety of myriads of bright-colored flowers which appeared for brief intervals after the infrequent rains.

Over most of the range, palatable forage was provided by mesquite browse and weeds which sprang up after rains. With increase in elevation toward the fringing mountains, however, the vegetation became more abundant, and at the highest elevations within the type were such true forage plants as Rothrock and black gramas, alkali sacaton, lovegrasses, and three-awns, and in certain situations saltgrass and galleta.

SALT-DESERT SHRUB

On the rolling alkaline soils of southwestern Wyoming, southern Idaho, Utah, and Nevada was the salt-desert shrub type, covering about 42 million acres, which resembled a low, scattered sagebrush formation. The predominant vegetation was a mixture of palatable low shrubs and scattered grasses. The most nutritious browse plants were shadscale, bud sagebrush, winterfat, and rabbitbrush. The most valuable grasses were wild-rye, squirreltail, Indian ricegrass, galleta, and alkali sacaton, and although these seldom were thick enough to develop a sod they formed fairly close stands in the less alkaline situations.

The composition of the plant cover varied according to the salt content of the soil, and consequently different areas were dominated by different species. Where the salt content was extremely high, pickleweeds and seepweeds occurred over great level expanses, but these were unpalatable and never of value for grazing. Under more favorable soil conditions the alkali sacaton formed a close sod over extensive flats where clumps of yellow-flowered rabbitbrush, 2 or 3 feet high, frequently appeared. On moderately alkaline areas, greasewood plants 2 to 5 feet in height were more or less evenly spaced from 5 to 8 feet apart; their bright green foliage contrasted strongly with the ashen hue of the low, hemispheric clumps of shadscale which frequently grew in mixture with the greasewood.

Even in its primitive condition the percentage of ground covered by the salt-desert vegetation was slight. A recent survey in Nevada of railroad rights-of-way which have been fenced for more than 30 years showed that grass covered only 1 percent and browse less than 3 percent of the total ground area. But even this apparently scant cover of vegetation furnished feed for thousands of game animals each winter.

PIÑON-JUNIPER

The first forest type usually encountered by the pioneers after crossing the Great Plains on their westward trek was the piñon-juniper. These low-growing, open forests of piñon pines and junipers occurred over 74 million acres from the eastern foothills of the Rocky Mountains in Colorado westward to central Oregon and

south through the foothill country of Utah, Nevada, eastern California, Arizona, and New Mexico. On the lower slopes of high mountains the piñon-juniper type formed a transition zone between the treeless sagebrush or similar shrub types and the denser forests growing at higher elevations. In many places, particularly on the elongated low ridges of Nevada, piñons and junipers were the only forest trees present in any abundance. Here the type occurred as large islands in a sea of sagebrush. The piñon-juniper type extended without a break over thousands of acres throughout the Southwest, and long fingers of this fringe forest type followed low, rocky ridges and other broken ground out into the semidesert plains.

The piñons and junipers were short, dense-crowned trees 20 to 40 feet tall, the individual trees generally growing rather far apart. Along the upper edge of the piñon-juniper belt, the pines often dominated the forest mixture, whereas, at the lower edge of the belt, the junipers ordinarily occurred in greater abundance than pine.

The piñon-juniper type was an important forage resource. The wide spacing of the trees permitted the development of considerable browse such as mountain-mahogany, bitterbrush, and cliffrose, as well as many palatable grasses and weeds, the more prevalent of which were the gramas, needlegrass, wheatgrass, bluegrass, and fescue.

WOODLAND-CHAPARRAL

Around the sides of the great central valley of California, on the low hills along the Pacific Coast from San Francisco south to Mexico, and in southern Arizona, the early-day traveler found vast brush fields composed of not one but dozens of different species of shrubs. These almost impenetrable thickets of bushes and stunted hardwood trees later acquired the name "chaparral." Associated with these chaparral thickets were large areas of comparatively open woodland, parklike stretches characterized by various species of oaks, and an understory of palatable grasses and herbs. Just as the piñon-juniper type elsewhere in the Southwest formed a transition zone between the grass or desert-shrub vegetation of the plains and the forests of the higher mountain slopes, so the woodland-chaparral formed a transition zone between the grass types and the higher mountain forests in southern California and Arizona. In California alone, the woodland-chaparral type covered about 10 million acres.

Although more than a hundred different species of shrubs and dwarfed trees intermingled to form this peculiar plant cover, its species composition varied considerably in different parts of the type. The most important species were highland live oak, poison-oak, scrub oak, hollyleaf cherry, sumac, ceanothus, and manzanita. At varying elevations the shrub species gradually merged with open oak woodlands.

The woodland portions of the type supported a good growth of valuable forage grasses and weeds. There was no available grass or herbaceous forage beneath the dense canopy of the brush portions of this type, and the brush itself was of low palatability. The chaparral, however, had enormous value for watershed protection, since its dense cover prevented soil washing and thus played a prominent part in preserving lower, more valuable grasslands.

OPEN FORESTS

Valuable forage occurred in the 131 million acres of open forests that grew on the slopes of practically every mountain range from the eastern foothills of the Rockies to the slopes of the Cascades and the Sierras. In these forests the trees were fairly wide-spaced, and a grassy floor beneath the trees added to a parklike appearance. Numerous clear mountain streams and the easy accessibility of the grass cover contributed to making these areas an extremely valuable part of the forage resource.

The most extensive areas of grazing land in the open-forest type were found under the ponderosa pine forests which occurred in large bodies throughout the West. In many localities the prevailing open-forest type was a pure stand of ponderosa pine; elsewhere it was a mixed stand of ponderosa pine, sugar pine, and incense cedar or a mixture of ponderosa pine and Douglas fir. At high elevations in the Rocky Mountains there were parks and meadows in openings between stands of Engelmann spruce and alpine fir. Here and there were areas of low-growing oaks, maples, and other mountain brush. In Colorado and adjacent Southwestern States the type included tracts of aspen and Douglas fir. Throughout the type were mountain meadows of luxuriant grass and palatable weeds.

Almost everywhere in the open forests was abundant forage composed of many different species of shrubs, grasses, and weeds. As might be expected, the forage species varied considerably throughout this very large region, depending on climate, soil, and to some extent on the kind of overtopping forest cover. For the type as a whole, however, the many valuable forage plants included blue grama, bluestem, various fescues, "beardless bunchgrass", wheatgrass, pinegrass, junegrass, bluegrasses, redtop, alpine timothy, needlegrasses, ricegrasses, and elk sedge; wild geranium, bluebells, yarrow, succulent vetches, and other nourishing weeds and palatable browse such as snowberry, bitterbrush, and mountain-mahogany.

These open forests and mountain meadows had a high value for forage. As a rule, this type occurred at rather high elevations, and its forage matured later than that of the lower ranges. For this reason the open-forest ranges later were to become an extremely important link in the grazing cycle for domestic livestock providing the all-important summer pastures and, in combination with the lower ranges, making possible yearlong grazing.

DENSE FORESTS

Not all of the forests of the West were suitable for grazing. Certain forest types were so dense that little herbaceous or shrubby vegetation was able to live in the deep shade, or if herbage did develop it was of low forage value. Included in the dense forest types were the western white pine-western larch forests of northern Idaho, thickets of lodgepole pine throughout the Rocky Mountains, redwood stands along the northern California coast, the fog-drenched Sitka spruce-western hemlock and Douglas fir forests of western Oregon and Washington, and parts of the Engelmann spruce-alpine fir forests of the high Cascade Range and the Rocky Mountains. Here and there in these dense forests were open, grassy meadows.

In the aggregate, these dense forests covered a very large area and comprised about 68 million acres. Occasional fires, started by lightning or by Indians, removed the forest cover temporarily, and for a few years deer and other wild animals found considerable feed in the burned areas, on which generally developed a good cover of such palatable plants as peavine and fireweed, until new forest growth shaded out these succulent plants.

WHAT THE RANGE RESOURCE OFFERED A GROWING NATION

In the days of the "Forty-niners" there were few settlements in all that vast territory lying between the Mississippi River and the Pacific Coast. True, the Spaniards had a few herds of cattle and sheep in the Southwest as early as 1598, and the Mormons in 1847 established a small colony on the shores of a great salt lake near the western foothills of the Rocky Mountains; there were a few military posts scattered here and there, and at various strategic points were isolated trading establishments of the great fur companies; and, of course, a few small, struggling communities had taken root in the fertile valleys adjacent to the Pacific Ocean.

Except for these rudimentary beginnings of settlement, the whole of the far-flung expanse of prairie, plain, desert, and mountain highland was virgin territory. It was virgin country in 1540 when the Spanish captain, Coronado, led the Conquistadores up from Mexico through what is now Texas and on northward over the lush grass of the never-ending plains. It was the free and unchallenged home of the buffalo and antelope in 1805 when Lewis and Clark made their intrepid march to the mouth of the Columbia. And it was still virgin territory in 1835 when Colonel Dodge and his party of Government explorers spent the entire summer following the Platte River toward its source, traveling across the Great Plains, along the frontal wall of the Rockies, and returning eastward by way of the Arkansas River. As late as 1858, buffalo roamed over the land where Denver now stands. Those who set forth three-quarters of a century ago to cross this vast, uncharted, little-known wilderness saw the land as Coronado saw it three centuries before. They saw a virgin range, an enormous, untapped natural resource.

This virgin range exhibited a wide variation in plant cover, but everywhere except in the desert areas, there was an abundance of palatable and nutritious plants suitable for the pasturage of wild game and, later, for domestic livestock. Before white settlement the range was used only by wild game. Although these animals were present in very large numbers, occasionally overgrazing local areas and variations in forage production were caused by droughts, some of which undoubtedly were as severe as those experienced in recent years, the range by and large was able to maintain itself. It would have continued to do so if the white man had not upset its natural and fairly stable equilibrium.

The magnificent opportunities for prudent utilization of this great natural resource could not have been fully appreciated by those who settled the range; for the story of the range is in part one of high hope and lofty ideals, and in part one of indifference to the welfare of the generations to follow. It is a story of the prodigal exploitation of a vast natural resource on an enormous scale.

III. THE WHITE MAN'S TOLL

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If the "Forty-niner" could but repeat his westward journey today, how different the range would appear! Where less than a century ago he spent weary weeks guiding his ox team over rolling prairies, wind-swept plains, and rugged mountains; where were but wagon

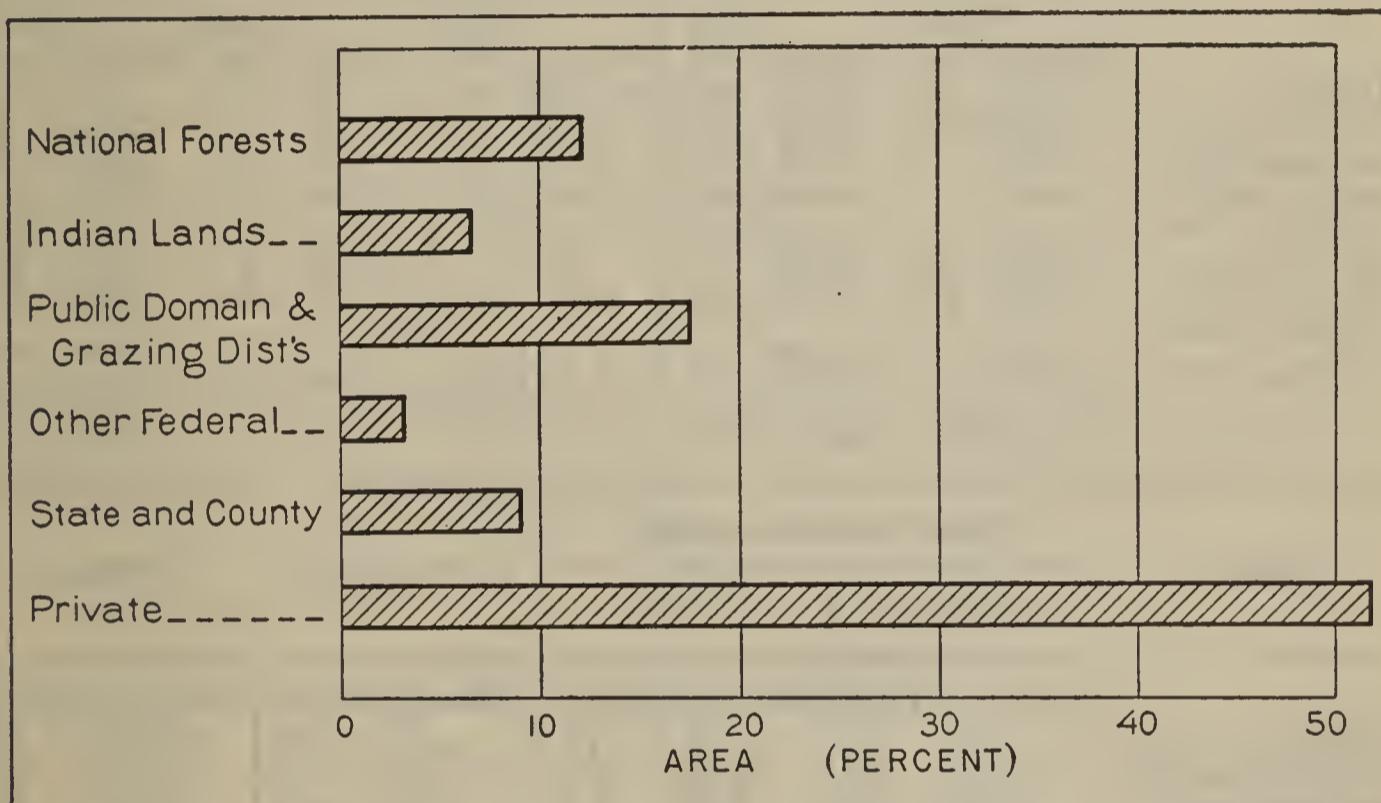


FIGURE 23.—OWNERSHIP DISTRIBUTION OF THE PRESENT RANGE AREA.

Of the immense area of "free range", more than half has passed into private ownership. National forests, Indian lands, and public domain divide up about 36 percent in the ratio, roughly, of 2-1-3.

tracks and isolated Indian villages in the days of the gold rush, he now would find a network of roads, farmsteads, cities, and towns. Enormous areas throughout this western country would still have somewhat the appearance of the "endless grasslands" that he knew; but beneath the appearance is a change that might elude the "Forty-niner"—the great depletion in quality and quantity of the forage resources that has taken place in the last 50 or 60 years.

Widespread, continuous, and exhaustive use of the forage has changed the whole character of the virgin range. The outstanding changes have been (1) the passage of much of the land from Federal ownership to other forms of control, (2) a reduction in the area available for range use, (3) a tremendous decrease in the quantity and quality of the forage, and (4) deterioration of the basic resource, the soil itself.

The ownership pattern of the virgin range has changed from virtually complete Federal ownership to a bewildering mosaic of intermingled State, county, municipal, private, Federal, and other ownerships. Even the land in Federal ownership or control is under various jurisdictions, such as the national parks and monuments, national forests, Indian lands, grazing districts, and unreserved public domain. Table 5 indicates for the present range area of 728,000,000 acres the approximate acreage in each of the several classes of ownership. The proportional area in each ownership is illustrated in figure 23.

TABLE 5.—*Distribution of virgin and present range areas by ownership or control and plant types*

Type	Approximate area of virgin range ¹		Present area, all ownerships	Federal ownership or control						
	1,000 acres	Percent		1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	
Tall grass-----	42,000	5.0	18,513	2.5	202	1.1	106	0.6	10	0.1
Short grass-----	280,000	33.0	198,092	27.2	993	.5	11,627	5.9	9,759	4.9
Pacific bunchgrass-----	61,000	7.2	42,534	5.8	1,714	4.0	461	1.1	1,689	4.0
Semidesert grass-----	93,000	11.0	89,274	12.3	1,636	1.8	12,353	13.8	7,686	8.6
Sagebrush-grass-----	90,000	10.6	96,528	13.3	3,637	3.8	2,158	2.2	43,237	44.8
Southern desert shrub-----	25,000	2.9	26,896	3.7	98	.4	2,409	8.9	6,424	23.9
Salt-desert shrub-----	42,000	5.0	40,858	5.6	366	.9	1,657	4.1	30,657	75.0
Pinon-juniper-----	74,000	8.7	75,728	10.4	13,811	18.2	10,352	13.7	22,302	29.5
Woodland-chaparral-----	10,000	1.2	13,406	1.8	712	5.3	78	.6	1,693	12.6
Open forests-----	130,550	15.4	126,367	17.4	64,785	51.3	7,190	5.7	4,335	3.4
All types-----	847,550	100.0	728,196	100.0	87,954	12.1	48,391	6.6	127,792	17.5

Type	Federal ownership or control				State and county		Private	
	Other Federal ²		All Federal					
Tall grass-----	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent
Short grass-----	137	0.7	455	2.5	787	4.2	17,271	93.3
Pacific bunchgrass-----	3,166	1.6	25,545	12.9	24,403	12.3	148,144	74.8
Semidesert grass-----	863	2.0	4,727	11.1	1,894	4.5	35,913	84.4
Sagebrush-grass-----	2,734	3.1	24,409	27.3	16,440	18.4	48,425	54.3
Southern desert shrub-----	6,147	6.4	55,179	57.2	6,558	6.8	34,791	36.0
Salt-desert shrub-----	1,530	5.7	10,461	38.9	5,792	21.5	10,643	39.6
Pinon-juniper-----	2,000	4.9	34,680	84.9	927	2.3	5,251	12.8
Woodland-chaparral-----	4,561	6.0	51,026	67.4	3,802	5.0	20,900	27.6
Open forests-----	120	.9	2,603	19.4	163	1.2	10,640	79.4
All types-----	22,997	3.2	287,134	39.4	65,516	9.0	43,568	34.5

¹ Exclusive of area east of boundary line shown in fig. 1. In addition to area shown here, the tall grass type is estimated to have covered 210,000,000 acres east of the boundary line shown in fig. 1.

² Including grazing districts.

³ Exclusive of 1,217,000 acres of grazable land in national parks and monuments, only 40,000 acres of which are actually grazed.

Changes in area have occurred in nearly every major plant type. Some have become larger. The sagebrush-grass range, for instance, has expanded at the expense of adjacent types from about 90 million to more than 96 million acres, and in California the woodland-chaparral vegetation covers 3.4 million acres more than at the time of white settlement. Some of the range types are considerably smaller, as, for example, the tall-grass prairie, much of which is now devoted to agricultural crops. The Pacific bunchgrass range also

has become considerably smaller, because a large part has been used for wheat production, orchards, and other agricultural crops, and because of the inroads made by encroaching sagebrush. The proportional distribution of the present range area in the different plant types is shown in figure 24.

In every part of the western range, lands have been taken for cities, roads, and for other needs of settlement. All told, as detailed in table 5, the total area of open range land is about 119 million acres less today than a century ago.⁶

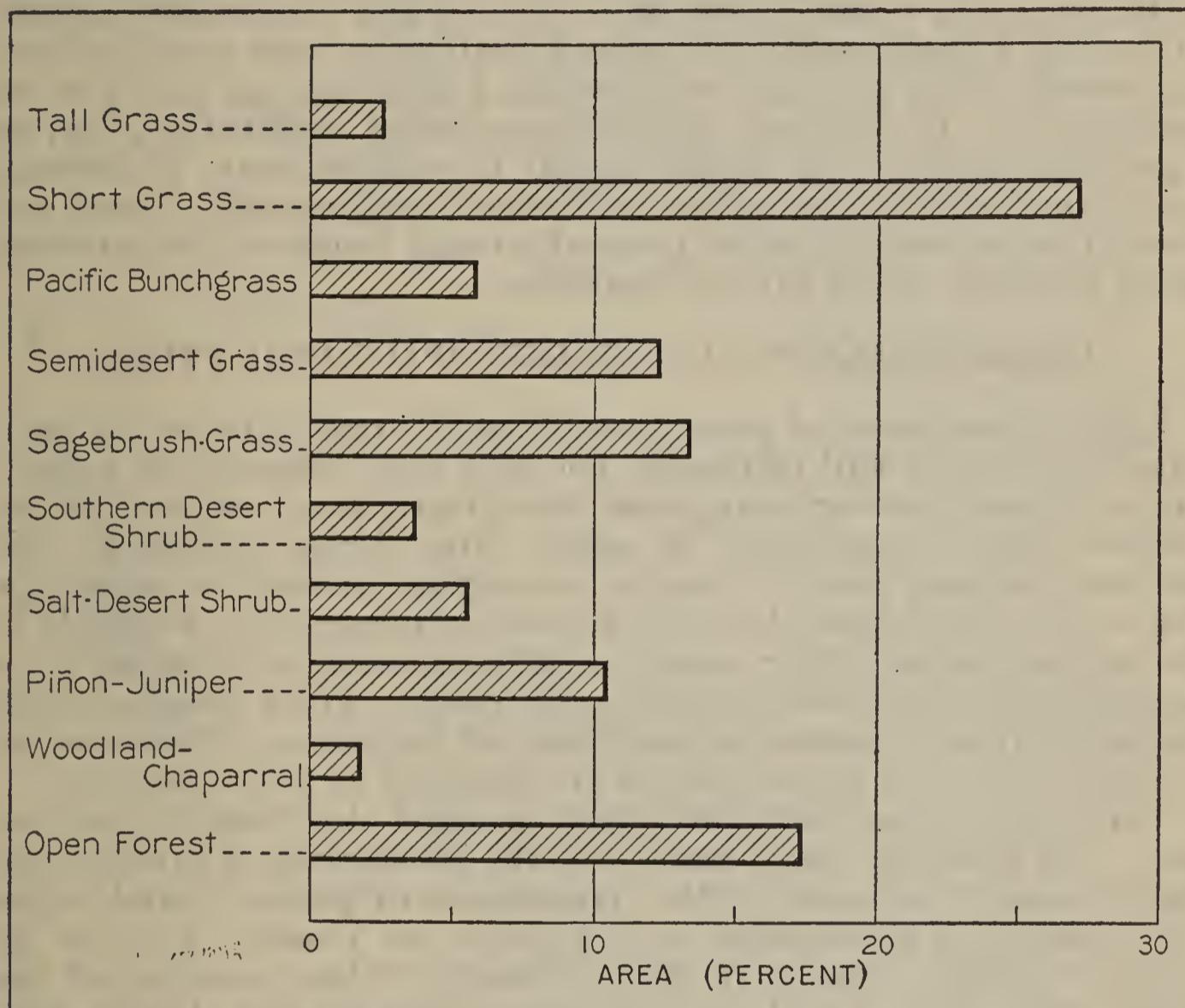


FIGURE 24.—TYPES OF RANGE FORAGE.

One-fourth and more of the present range area is in the very valuable short-grass type. The first four principal grass types (shown in fig. 25) account for nearly a half of the total area.

By far the most significant departure from virgin range conditions is the change in the plant cover. Although varying in density under different forms of management, the plant cover in every range type is depleted to an alarming degree. Many valuable forage species have disappeared entirely. Palatable plants are being replaced by unpalatable ones. Worthless and obnoxious weeds from foreign countries are invading every type. And throughout the entire western range the vegetation has been thinned out until even

⁶ About 2 million acres of former range have been used for cities, highways, and other needs of settlement; about 116 million acres for farm crops; and 1 million acres of grazable lands are included in national parks and monuments. Also not included are about 68 million acres of dense forests and 59 million acres of deserts and inaccessible areas which never have been usable as range.

conservative estimates place the forage value at less than half of what it was a century ago. This loss in forage values from virgin range conditions is referred to as "range depletion."

Accompanying the loss in plant cover has come about an inevitable soil deterioration. Depletion of the plant cover meant the loss of a shielding cover of herbage to break the force of rains and ease the water gently into the soil; of a litter cover of dead and decaying leaves to filter the running water and thus prevent clogging the soil pores with silt; of a generous admixture of humus to aid in catching and absorbing the waters rushing over steep hillsides; of a mass of fibrous plant roots to keep the soil loose and friable and capable of holding a large quantity of water; as all these were lost, the holding power of the good soil was gone and it became an easy prey to soil erosion. It was and is a self-continuing destruction, for, as more and more of the fertile topsoil is washed away, it becomes increasingly difficult for plants to reestablish a protective cover, and floods from severely denuded parts of a range frequently ruin nearby areas which lie in the path of mudflows.

FORAGE DEPLETION IN THE PRINCIPAL RANGE TYPES

A brief description of present conditions of vegetation in the principal range types will emphasize not only how different the present range is from the virgin range but how greatly every range type has suffered, and is continuing to suffer, from forage depletion. No attempt has been made to develop a complete picture for each type but only to select from the large amount of information available in Forest Service and other records a sufficient number of examples to depict general conditions as they exist today.⁷ These short accounts deal entirely with vegetative conditions of the range. The causes of forage depletion and the remedies are discussed in later chapters.

Throughout these accounts it will be noted that forage depletion may (and generally does) mean that the plant cover is thinner; depletion also is indicated by the replacement of palatable and nutritious plants by unpalatable or less nutritious plants. Even in its virgin condition there were minor changes in the character of the plant cover, which was thicker one season than another; having now more plants of a certain species, now fewer. But in general there was a biological balance, a natural equilibrium, which year in and

⁷ These are for the most part taken from unpublished data of the Forest Service. For many years the Forest Service has collected data on range conditions but to obtain more information on the present range, especially for areas outside the national forests, an extensive survey of the entire western range was started in 1932 and completed in the fall of 1935. The tables presented here are based upon the observations of more than 100 Forest Service officials, skilled in judging range conditions and familiar with the country examined. As a basis for judging range conditions these men had the results obtained through periodic reexaminations over many years of 6,300 permanently marked sample plots. In addition, forage conditions on more than 14,000 sample plots were estimated during the 4 years the survey was in progress.

Knowledge of original forage conditions was obtained by examination of remnants of the virgin range and of "protected" areas such as ungrazed fence corners, cemeteries, and railroad rights-of-way where the present vegetation is at least indicative of virgin range conditions. The forage values of present ranges were estimated in terms of those of the virgin range, and present range lands were grouped into four broad classes: 0-25, 26-50, 51-75, and 76-100 percent decline from original forage values. A map (fig. 38, p. 110) was prepared, outlining in a general way these four broad classes of forage depletion. Comparison of this map with those showing distribution of range types (figs. 25, 30, and 34) and with estimates of land ownership was the basis for preparation of the forage depletion tables presented in this chapter.

The plant types described are generalized, each inevitably including small areas of other types. The principal subtypes are detailed in the appendix, p. 600. A similar generalization is unavoidable in delimiting the depletion classes.

year out maintained the distinctive character of the plant type, only occasionally upset by certain natural phenomena such as drought, fire, and localized overgrazing by big game animals.

When the white man came, his disturbance of this balance was of a more far-reaching nature. He allowed too many of his grazing ani-

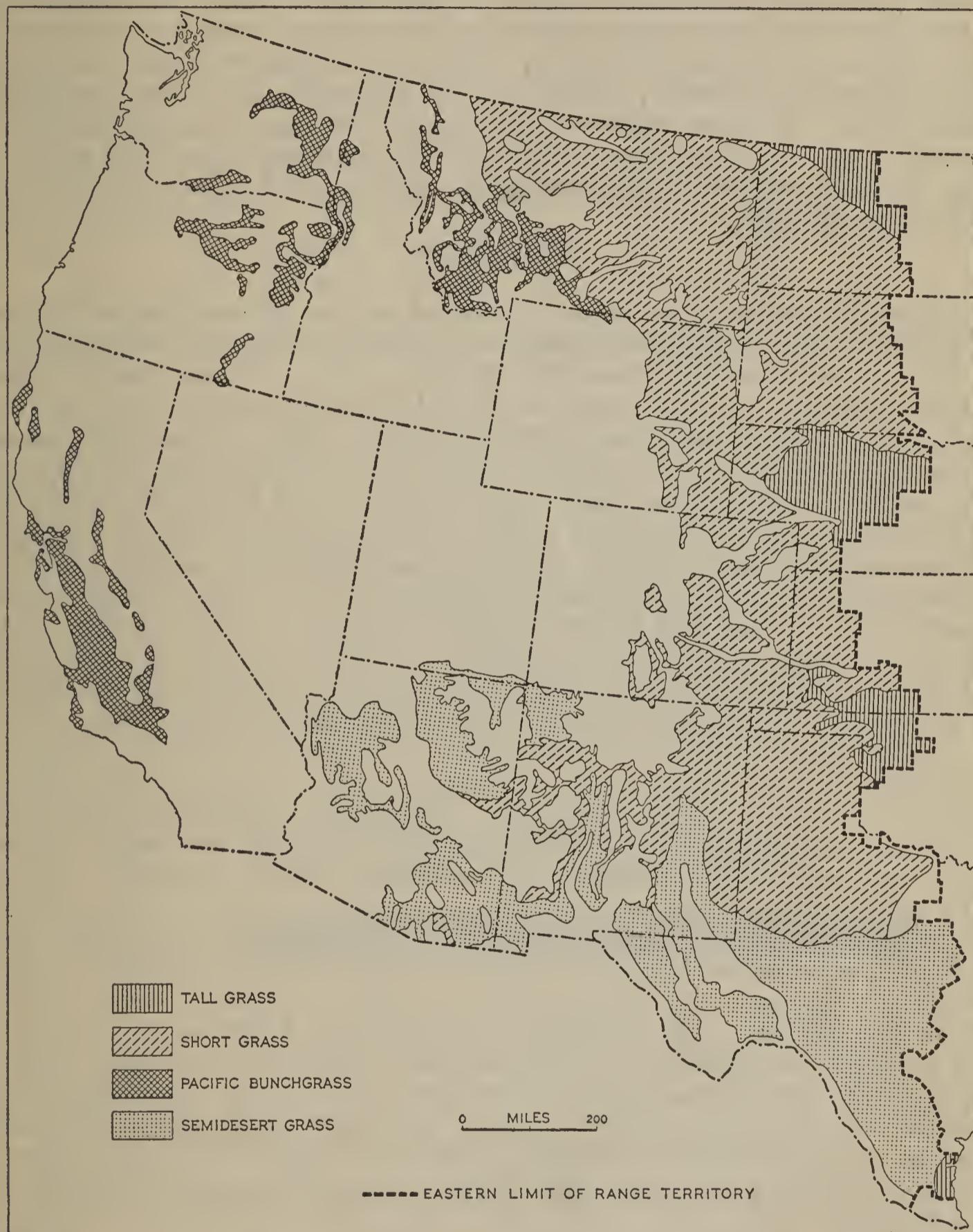


FIGURE 25.—The principal grass types within the boundary of the present range, among which the short-grass type takes first place in area and grazing value.

mals to use the range, with the result that thinning of the plant cover and packing of the soil induced soil erosion and made natural regeneration more difficult for the remaining plants. Early grazing prevented the development of adequate seed crops. These and other factors entirely changed the site conditions and brought about large changes in the character of the vegetation. As a rule, it was the

poorer plants which were able to survive on the deteriorated sites, and eventually they gained possession of the areas. In some instances, these were the plants best able to endure the deteriorated site conditions; in others, the plants that domestic livestock would not eat obviously were left to reseed the area while plants relished by livestock were consumed before seed could be produced. Thus the deterioration of the site has brought about a more or less complete change in the character of the plant cover. This in turn has wrought a change in the grazing capacity, which, as here expressed in animal units, is the number of acres required to support one unit of domestic livestock (i. e., one cow, horse, or mule; or five sheep, goats, or swine) for 1 month without endangering the continued forage productivity of the range land.

TALL GRASS

No other range type has so decreased in size as has the tall grass (fig. 25). The tall-grass prairies originally extended as far east as Indiana and covered about 252 million acres. Today farm lands largely replace the tall grass of the Middle West and much of the 42 million acres considered in this report.⁸ Only 18.5 million acres remain in range use, for here, too, the soil was fertile and the climate favorable to crop production. As can be seen in figure 25, the bulk of the tall-grass range is now in four widely separated places—North Dakota, Nebraska, southern Kansas and Oklahoma, and the Texas coastal plain; and approximately 93 percent of it is privately owned (table 5). It has less forage depletion than any other part of the western range, and despite its greatly reduced acreage the tall-grass type is an important part of the forage resource because of the large numbers of livestock it can support on relatively small areas.

About three-fourths of the present tall-grass range is in good condition; the rest has experienced appreciable changes in the make-up of its plant cover (table 6). Relatively unchanged are the sand hills and native hay meadows of northwestern Nebraska. Here in a compact body of range land covering about 12 million acres, the plant cover has essentially the same species as when plant collections were made in 1839-58 (131). In North Dakota, Kansas, and Oklahoma, sagebrush, yucca, shinnery oaks, and other more or less unpalatable weeds and shrubs have usurped the place of the nutritious tall grasses. For example, examinations of the sand hills south of Garden City, Kans., in 1902 and 1904 showed that prairie beard-grass and prairie sandgrass were present in large quantities but sagebrush and yucca were scarce. In 1935 sand sagebrush and yucca were the dominant species, whereas it was now prairie beard-grass and blue grama that were scarce—a complete reversal of types in 30 years.

⁸ As already stated in the previous chapter, the 210 million acres of tall grass east of the boundary line in fig. 25 are not considered as within the present range area.

TABLE 6.—*Depletion of virgin range in the tall-grass type, by ownership and depletion classes*

Ownership or control	Moderate depletion (0-25 percent)		Material depletion (26-50 percent)		Severe depletion (51-75 percent)		Extreme depletion (76-100 percent)		All depletion classes	
	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent
Federal:										
National forests-----	202	100	0	0	0	0	0	0	202	100
Indian lands-----	76	72	30	28	0	0	0	0	106	100
Public domain—grazing districts-----	10	100	0	0	0	0	0	0	10	100
Other Federal ¹ -----	137	100	0	0	0	0	0	0	137	100
All Federal ¹ -----	425	93	30	7	0	0	0	0	455	100
State and county-----	787	100	0	0	0	0	0	0	787	100
Private-----	12,377	72	4,145	24	0	0	749	4	17,271	100
All ownerships-----	13,589	73	4,175	23	0	0	749	4	18,513	100

¹ Exclusive of 1,217,000 acres of grazable land in national parks and monuments, only 40,000 of which is actually grazed.

Included in the 73 percent of the type in reasonably good condition are the sand hills of Nebraska and the small area in the Texas Coastal Plain shown in figure 25. That so much of the type as a whole is in this condition today is undoubtedly the result of abundant rainfall coupled with the deep-rooting habit of the tall grasses and their remarkable recuperative powers. Abuse which in other range types would have quickly brought destruction has harmed the tall grass only slightly. Material forage depletion occurs in North Dakota and on part of the type in Kansas, but most of the tall-grass range in Kansas and Oklahoma, about 4 percent of the total area in tall-grass range, has lost nearly all of its former forage value.

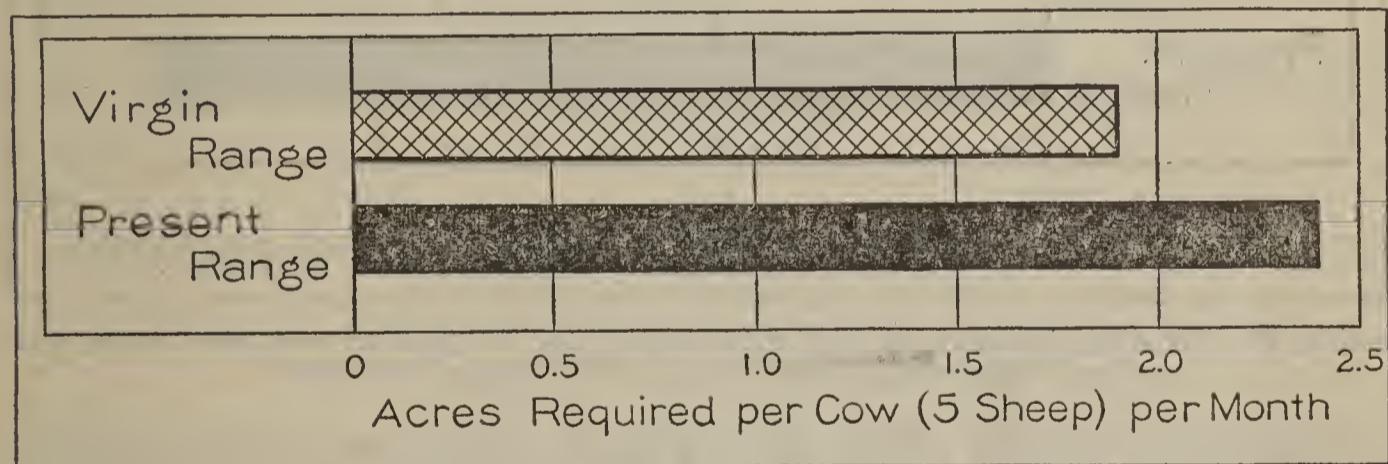


FIGURE 26.—Estimated grazing capacity on present tall-grass range requires nearly one-fifth greater area per cow (or 5 sheep) than on the virgin range.

Grazing capacity, estimated for both the virgin and the present range, as described on page 509, is shown in figure 26. In this respect, as in others, the tall-grass type has the advantage of most of the types which follow.

Although most of the tall-grass type is in reasonably good condition today, the present trend in forage values is thought to be downward on about 90 percent of the entire tall-grass range (table 25, p. 116). Unquestionably, the drought of the past few years has had a part in this decline, but drought alone has caused only about one-third of the total loss in forage grasses in this type. Overgrazing, especially during the recent drought period, is the factor chiefly

responsible. Since practically all of the tall-grass type is in private ownership, the responsibility for checking this downward trend of forage values and rebuilding the plant cover rests with the farmers and livestock operators using this range. On portions of the Nebraska National Forest the grazing capacity under controlled use has been increased 55 percent in the last 23 years, indicating the progress possible under systematic range management.

SHORT GRASS

The short grass is the largest of the range types, covering 198 million acres (fig. 25). Of this, three-fourths is privately owned (table 5); although millions of acres plowed for agricultural crops are now reverting to public ownership for nonpayment of taxes. With many interspersed areas under various forms of Federal and State control, the short-grass type has become an enormous patch-work of farms, pasture lands, and open range upon which an increasingly complex pattern of ownership is being superimposed.

The short grasses are hardy, and this type is much less susceptible to damage through overuse than are other grass types. The forage value of the present short-grass range, however, is considerably less than that of the virgin range because of changes in the plant cover. The replacement of palatable species by inferior plants has contributed to this decline, but the major factor in range depletion has been the marked thinning of the plant cover.

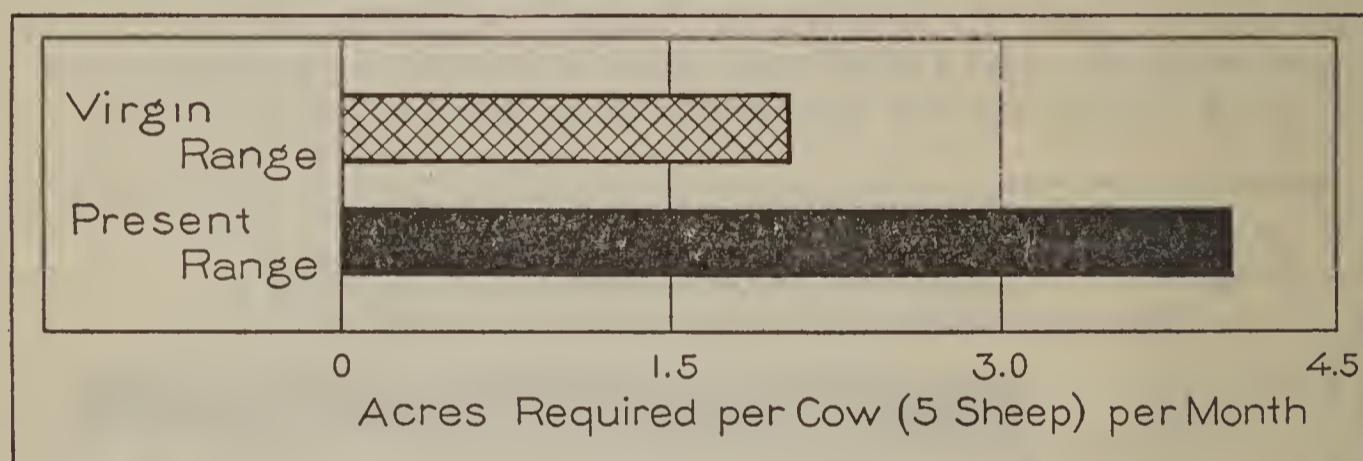


FIGURE 27.—Grazing capacity of the short-grass type at present requires nearly twice the range area estimated for virgin-range conditions.

A large proportion of the short grasses in the original plant cover of these plains has been replaced by weeds and shrubs of low palatability, such as sand sagebrush, Russian-thistle, sunflower, asters, pigweed, goldenrod, and peppergrass. In western Kansas, eastern Colorado, and southward, the worthless snakeweed, gumweed, and cactus now dominate many areas. Where mixed prairies once existed along the Arkansas River, the grasses have almost completely disappeared and sand sagebrush, Russian-thistle, and yucca now constitute 60 percent of the total plant cover. On the high plains of western Texas, weeds like Russian-thistle and broomweed comprise from 20 to 40 percent of a plant cover in which grasses once were 85 percent dominant. In eastern Colorado, grasses once comprised 86 percent of the plant cover but now constitute only 56 percent of the vegetation, whereas weeds have increased from 14 to 34 percent.

Accompanying this decrease in forage quality is the even more serious decrease in volume of forage through thinning of the entire plant cover. The vegetation in general is only half as thick as it was when the white man first began to use the range for pasturage. The recent drought is responsible for a certain amount of the thinning. It is worth noting, however, that small remnants of the short-grass range protected from grazing have nearly 10 times as thick a plant cover as adjacent areas exposed to the same drought conditions but long overgrazed by livestock.

As a result of this loss in quality and decrease in volume of vegetation, the forage value of the short-grass range is much less than that of the virgin range, and that this condition is widespread is indicated by the following figures from an extensive survey made in 1935:

Decline from original forage value:	Percent
Southwestern North Dakota-----	25-50
Northwestern and western South Dakota-----	37-43
Northeastern Colorado, western Nebraska and southeastern Wyoming-----	50-60
Southwest Nebraska and northwestern Kansas-----	50-75
Western Texas-----	50-70

Forage in southeastern Colorado, the "dust-bowl" area, has lost 88 percent of its former value. The forage of about 13 percent of the entire short-grass area has been extremely depleted, more than three-fourths materially or severely depleted, and only about 8 percent can be classed as being in reasonably good condition (table 7). It is significant, as shown in table 7, that of the severely and extremely depleted short-grass range more than 80 percent is privately owned. One of the best indications of what has happened is the contrast afforded by figure 27 between grazing capacity of the short-grass type now and a century ago.

TABLE 7.—*Depletion of virgin range in the short-grass type by ownership and depletion classes*

Ownership or control	Moderate depletion (0-25 percent)		Material depletion (26-50 percent)		Severe depletion (51-75 percent)		Extreme depletion (76-100 percent)		All depletion classes	
	1,000 acres	Per-cent	1,000 acres	Per-cent	1,000 acres	Per-cent	1,000 acres	Per-cent	1,000 acres	Per-cent
Federal:										
National forests-----	401	40	471	48	121	12	0	0	993	100
Indian lands-----	1,348	12	8,603	74	1,624	14	52	(1)	11,627	100
Public domain—grazing districts-----	547	6	5,151	53	3,855	39	206	2	9,759	100
Other Federal-----	176	5	590	19	2,400	76	0	0	3,166	100
All Federal-----	2,472	10	14,815	58	8,000	31	258	1	25,545	100
State and county-----	1,809	7	16,514	68	5,074	21	1,006	4	24,403	100
Private-----	11,766	8	70,361	47	41,350	28	24,667	17	148,144	100
All ownerships-----	16,047	8	101,690	51	54,424	28	25,931	13	198,092	100

¹ Less than 0.5 percent.

The best available information indicates that for the past quarter century about 95 percent of the whole short-grass range has steadily declined in forage value (table 24, p. 115). Nor is it likely that the present poor condition of this range marks the end of its down-

ward trend, unless more care is given the range than in the past; for depletion has been halted on only 4 percent of the type during the past 5 years and approximately 94 percent of the short-grass area is thought to be still on the downgrade (table 25, p. 116). The short-grass type, however, has remarkable recuperative powers. With favorable weather conditions and adequate care, it recovers quickly.

PACIFIC BUNCHGRASS

The Pacific bunchgrass is the most valuable grass type west of the Great Plains (fig. 25). Since settlement, however, it has lost much of its original importance because the total area of the type is smaller, and also because of a tremendous decline in the forage value of the remaining bunchgrass range.

Bunchgrass originally covered about 61,000,000 acres, but very large areas in eastern Washington and north-central Oregon have been turned to wheat production and in California much of the land which originally supported bunchgrass is now devoted to orchards and other agricultural crops. The invasion of sagebrush has still further decreased the area of the bunchgrass type, which is now estimated to be only 42.5 million acres. About 84 percent of the bunchgrass range is privately owned and most of the rest is in Federal ownership, chiefly as unreserved public domain and national forests.

Many of the valuable plants of this type have almost entirely disappeared, notably the immensely valuable bluebunch wheatgrass on large areas in eastern Oregon, Washington, Idaho, and California. Other native bunchgrasses have been largely replaced by bur-clover, "filaree", slender oat, and other plants of foreign origin. Occasionally these introduced plants have considerable forage value but they seldom compensate for the disappearance of the native vegetation. Many of the plant immigrants are worthless as feed for livestock, some are poisonous, and others are mechanically injurious, especially to lambs. Downy chess, locally called "cheatgrass", an inferior forage plant that came to this country from abroad, is of but moderate forage value for only a few weeks during the year but is now dominating large areas formerly occupied by bunchgrass. Even casual observers note the astonishingly wide distribution of Russian-thistle on the bunchgrass range.

The marked decline in forage value of the bunchgrass range can be traced in part to a general thinning of the plant cover, but chiefly to a distinct change in the character of the vegetation. Sample plots located on representative areas in Idaho, Oregon, and Washington, indicate that the outstanding feature of the change in character of the plant cover is the shift from perennial grasses to annual grasses. As shown in table 8, perennial grasses constituted approximately three-fourths of the original plant cover but form only a small portion of the present cover. Annual grasses, which were only 12 percent originally, now comprise 51 percent of the vegetation. The significance of this replacement of valuable perennial grasses by annual grasses of low palatability is at least partly reflected in the great reduction in grazing capacity of this type as shown in figure 28.

TABLE 8.—*Approximate composition of the plant cover on the bunchgrass range in Idaho, Washington, and Oregon*

Composition	Range	
	Virgin	Present
	Percent	Percent
Perennial grasses	76	4
Annual grasses	12	51
Weeds	10	35
Shrubs	2	10
Total	100	100

The fact that the plant cover of much of the present range is only about 60 percent as thick as that of the virgin range further explains this very considerable reduction in forage value of the bunchgrass range of today. Some parts of the present bunchgrass range are estimated to be only 30 percent as valuable for feed as under virgin conditions. For the type as a whole, as indicated by table 9, less than a tenth is only moderately depleted, whereas 55 percent is severely depleted, or worse.

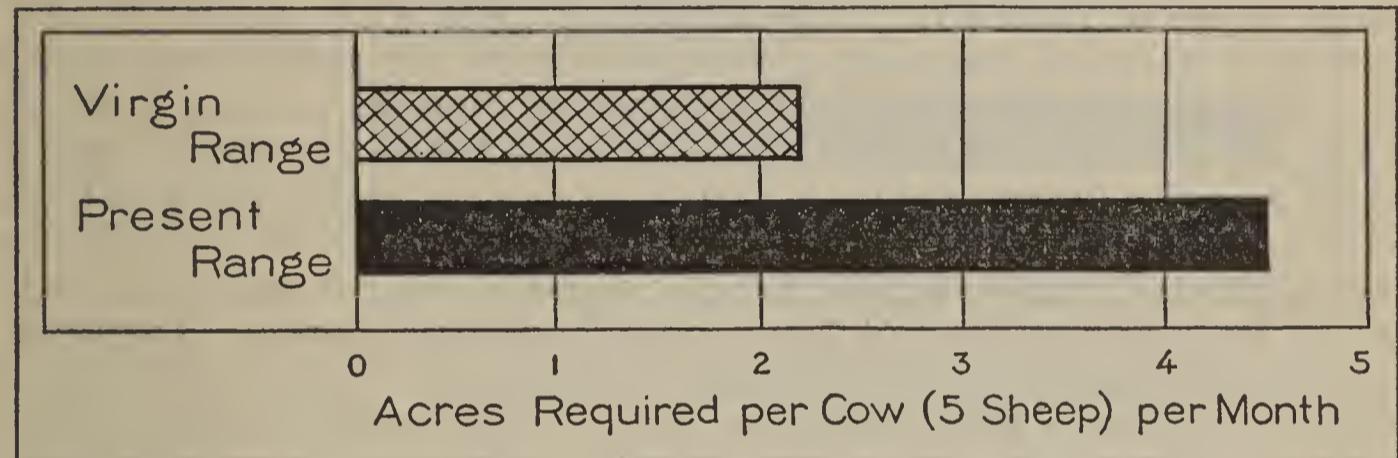


FIGURE 28.—More than twice the area per cow is required today on Pacific bunchgrass ranges that sufficed under normal conditions.

Even more alarming than the indication that nearly all the forage is gone on more than half of the bunchgrass range is the generally recognized fact that forage depletion is still continuing in this type. Recent estimates suggest that on less than one-fifth of the bunchgrass range has forage depletion been halted or the range improved (tables 24 and 25, pp. 115 and 116); and still further deterioration may be expected on the remainder.

TABLE 9.—*Depletion of virgin range in the Pacific-bunchgrass type by ownership and depletion classes*

Ownership or control	Moderate depletion (0-25 percent)		Material depletion (26-50 percent)		Severe depletion (51-75 percent)		Extreme depletion (76-100 percent)		All depletion classes	
	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent
Federal:										
National forests	502	29	779	46	433	25	0	0	1,714	100
Indian lands	0	0	39	9	236	51	186	40	461	100
Public domain—grazing districts	0	0	220	13	878	52	591	35	1,689	100
Other Federal	0	0	308	36	360	42	195	22	863	100
All Federal	502	11	1,346	28	1,907	40	972	21	4,727	100
State and county	50	3	725	38	962	51	157	8	1,894	100
Private	2,932	8	13,521	38	17,852	50	1,608	4	35,913	100
All ownerships	3,484	8	15,592	37	20,721	49	2,737	6	42,534	100

SEMIDESERT GRASS

The chief range of the Southwest is that characterized by the nutritious grasses of the semidesert-grass type (fig. 25), which retain their palatability during the mild winters of this region. In Arizona this type is much used for winter sheep grazing; for yearling cattle grazing in Arizona and New Mexico; and for cattle, sheep, and goats in the Trans-Pecos region of Texas. More than half of its 89 million acres is in private ownership.

Most of the semidesert-grass type shows a marked loss in forage value from that of the virgin range. Three important plants—alkali sacaton, sacaton, and bush muhly ("hoe grass")—have almost entirely disappeared from the type. Gully and arroyo erosion has carved the soil from valleys that once supported magnificent stands of the sacaton grasses (63). Hoe grass, which now is seldom found except on areas inaccessible to livestock or as an occasional tuft under the protection of cacti and thorny shrubs, was so abundant in 1879 and 1880 that hundreds of tons were delivered as hay to Government military posts in Arizona (12).

As the gramas and other valuable forage grasses disappear, the range is being restocked with inferior grasses and weeds. A specific illustration of this shift in composition of the plant cover, based on studies on the Rio Grande watershed in New Mexico, is given in table 10.⁹ It will be noted that on conservatively grazed areas, which to some extent indicate virgin range conditions, the palatable forage grasses comprise nearly the whole plant cover, whereas on the heavily grazed lands characteristic of much of the present range only half of the cover consists of these valuable forage grasses. Dominating many areas formerly occupied by valuable forage grasses are such poor grasses and worthless weeds as burrograss, ring muhly, fluffgrass, three-awn ("poverty grass"), snakeweed, Russian-thistle, and jimmyweed ("burroweed"). Cholla cactus has invaded many square miles in central Arizona and on former grasslands creosote-bush is encroaching. Drymaria, a deadly poisonous species, has increased on overgrazed clay flats in New Mexico, and in southwest Texas, bitter rubberweed, which also is poisonous, has appeared in many places (30, 84). In New Mexico, as the valuable black grama disappears the range gradually becomes more and more an essentially worthless mesquite-sand-dune shrub type (29).

TABLE 10.—*Approximate composition of herbaceous cover on a semidesert-grass range in New Mexico*

Composition	Conservatively grazed lands		Heavily grazed lands	
	Percent	Percent	Percent	Percent
Good grasses (black grama, blue grama, side-oats grama).....	85			50
Poor grasses (ring muhly, dropseed, three-awn).....	6			10
Weeds and shrubs.....	9			40
Total.....	100			100

⁹ Cooperrider, C. K., and Hendricks, B. A. Soil Erosion and Streamflow in Relation to Land Resources and Human Welfare on the Upper Rio Grande Watershed. U. S. Dept. Agr. Tech. Bull. (In process of publication.)

A valuable forage plant which has come into the semidesert type is alfileria, or "filaree." This plant appeared in the 1870's (143) and is excellent feed in wet years, but since in this type it occurs in abundance only in southern Arizona and produces a good crop of feed only in occasional years, it does not fully compensate for the loss of perennial grasses which it is replacing.

In addition to the loss of valuable forage plants, the plant cover of the present semidesert-grass range is thinner. For example, on the upper Rio Grande watershed in New Mexico it is estimated to be only about 40 percent as thick as that of the virgin range. Other studies on representative areas in the Trans-Pecos region of western Texas also indicate that the plant cover on many present ranges is scarcely 40 percent as thick as that on ungrazed areas in the same region.

As a result of this marked thinning of the plant cover and the widespread loss of valuable forage plants, the value of the semidesert range for feed has diminished greatly. Fully two-thirds of

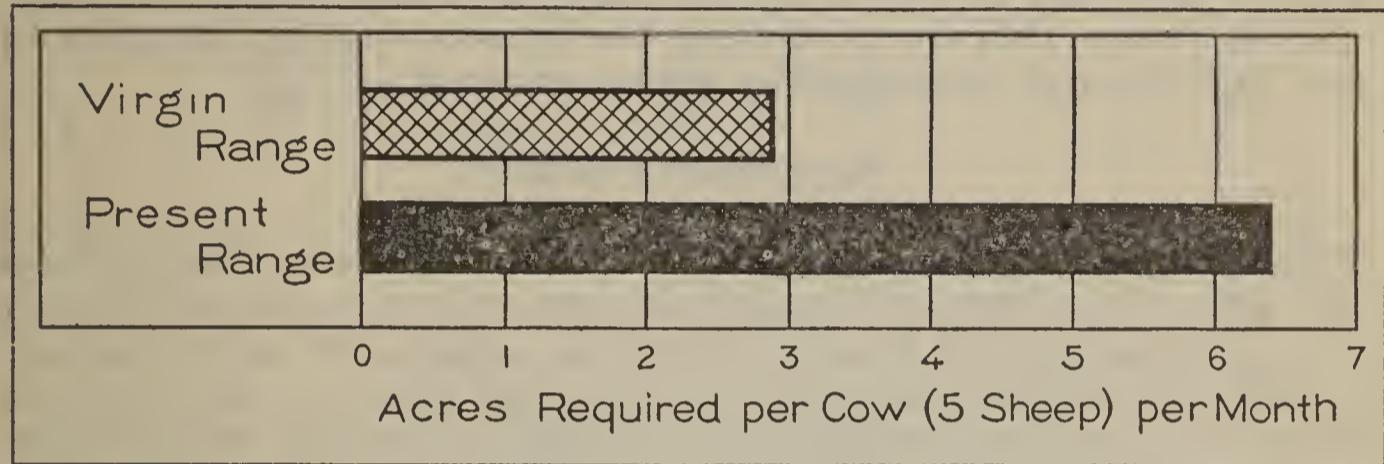


FIGURE 29.—Because of the serious loss in grazing capacity in the semidesert-grass type, nearly 6½ acres is required per cow where 3 acres once furnished ample feed.

the semidesert range has less than half the forage value it once possessed (table 11) and, as a whole, this range is one of the most severely depleted range types of the entire West, as indicated by the grazing-capacity comparison in figure 29.

TABLE 11.—*Depletion of virgin range in the semidesert-grass type by ownership and depletion classes*

Ownership or control	Moderate depletion (0 to 25 percent)		Material depletion (26 to 50 percent)		Severe depletion (51 to 75 percent)		Extreme depletion (76 to 100 percent)		All depletion classes	
	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent
Federal:										
National forests-----	50	3	809	49	470	29	307	19	1,636	100
Indian lands-----	162	1	579	5	11,197	91	415	3	12,353	100
Public domain—grazing districts-----	100	1	2,353	31	3,967	52	1,256	16	7,686	100
Other Federal-----	0	0	100	4	2,228	81	406	15	2,734	100
All Federal-----	312	1	3,841	16	17,862	73	2,394	10	24,409	100
State and county-----	366	2	6,806	42	9,054	55	214	1	16,440	100
Private-----	1,639	3	14,621	30	30,447	63	1,718	4	48,425	100
All ownerships-----	2,317	3	25,268	28	57,363	64	4,326	5	89,274	100

Aside from loss in forage values, the deterioration of the plant cover has permitted the occurrence of destructive floods. Investiga-

tions in Arizona disclosed that thinning of the plant cover increased run-off of summer rains and greatly accelerated the rate of soil loss. One of a pair of lysimeter study plots, for example, had 51 percent less grass cover than the other and on this plot the run-off of summer rainfall was 46 percent greater and the rate of soil loss almost 500 percent greater than on the adjoining plot with the thicker plant cover.

The trend of range depletion is estimated to be downward on about 90 percent of the semidesert-grass type (table 24, p. 115). The most serious situation at present is on areas of long-established use as in the Pecos, Rio Grande, Gila, and Santa Cruz Valleys where prompt action must be taken to save these ranges. Although this type is very susceptible to damage by overgrazing, and climatic conditions make recovery slow and difficult, experience on the Tonto National Forest in central Arizona proves that if forage depletion and soil erosion are not too far advanced, depleted ranges can be restored. On this forest, certain semidesert-grass ranges deteriorated by year-long overstocking of cattle have been improved about 35 percent since 1927 by protecting the grasses during the growing season and through conservative winter grazing.

SAGEBRUSH-GRASS

Third largest of all the range types and more than twice as large as any other shrub type, the sagebrush-grass is an important part of the forage resource and in many localities is the only range available (fig. 30). With the exception of the true grass areas, the sagebrush-grass ranges are potentially the most productive of any of the range vegetation types. The northern portions are much used for spring-fall range, and, because stockmen are dependent upon it for feed in those seasons, it forms an indispensable link between the winter and summer ranges.

The 96.5 million acres now in this type include an increase of about 6.5 million acres beyond the area occupied under virgin conditions. This increase in area has been at the expense of bunchgrass in the Pacific Northwest and short grass in Wyoming. Locally many grass meadows also have been invaded by sagebrush. Thousands of acres of sagebrush lands have been turned to crop agricultural purposes, especially where irrigation was possible, but the greater portion of the type still remains open range. Nearly half of the total area used as range is open public domain, and over a third is privately owned.

In its original condition the sagebrush range consisted of a rather sparse cover of sagebrush beneath which was a rich stand of palatable perennial grasses and weeds. Today the sagebrush has thickened greatly and in parts of Oregon, for example, has increased more than 60 percent. The palatable perennial grasses and weeds, however, have almost entirely disappeared. Perennial grasses on the Snake River Plains of Idaho are only one-fourth, and on representative areas in Oregon but half as thick as on remnants of the virgin range. The grass cover on sagebrush lands in central Nevada is only 10 percent, in northern Nevada 24 percent, and in western Utah 36 percent as thick as formerly. Over a large part of the type practically the only feed left for livestock is the very inferior sagebrush itself.

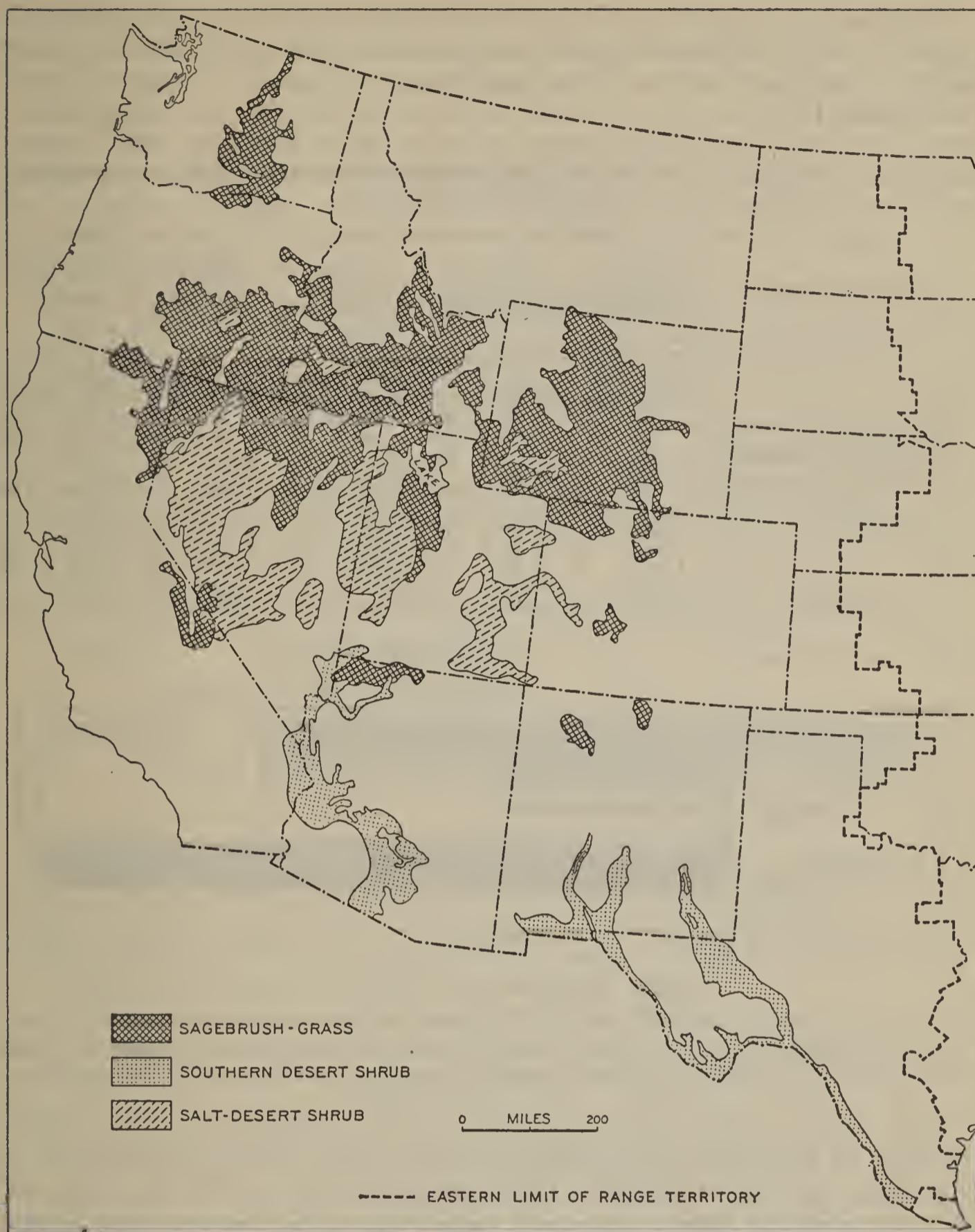


FIGURE 30.—THE PRINCIPAL SHRUB TYPES OF THE PRESENT RANGE.

Much of the southern desert-shrub type in the contiguous portions of California and Arizona is omitted, since these areas are virtually ungrazable.

It is this tremendous loss of forage grasses and weeds that has brought about the present low grazing capacity indicated in figure 31. It is estimated that grazing capacity in different parts of the type is 60 to 90 percent less than it was in pioneer days, as shown below:

Decline from virgin forage value:	Percent
Southern Idaho	68
Eastern Oregon	65
Colorado and Wyoming	60-70
Western Colorado (badly depleted public domain)	90
Northern Nevada	71
Western Utah	69

For the type as a whole it is estimated that the forage on about 84 percent of the sagebrush-grass range has been severely or extremely depleted and has been at least materially depleted on nearly all the rest (table 12).

TABLE 12.—*Depletion of virgin range in the sagebrush-grass type by ownership and depletion classes*

Ownership or control	Moderate depletion (0-25 percent)	Material depletion (26-50 percent)	Severe depletion (51-75 percent)	Extreme depletion (76-100 percent)	All depletion classes					
Federal:										
National forests-----	1,000 acres 417	Per- cent 11	1,000 acres 2,455	Per- cent 68	1,000 acres 733	Per- cent 20	1,000 acres 32	Per- cent 1	1,000 acres 3,637	Per- cent 100
Indian lands-----	7	(1)	1,612	75	470	22	69	3	2,158	100
Public domain—grazing districts-----	232	1	2,509	6	22,959	53	17,537	40	43,237	100
Other Federal-----	0	0	2,531	41	2,706	44	910	15	6,147	100
All Federal-----	656	1	9,107	16	26,868	49	18,548	34	55,179	100
State and county-----	105	2	2,469	38	2,704	41	1,280	19	6,558	100
Private-----	1,058	3	1,920	6	16,076	46	15,737	45	34,791	100
All ownerships-----	1,819	2	13,496	14	45,648	47	35,565	37	96,528	100

¹ Less than 0.5 percent.

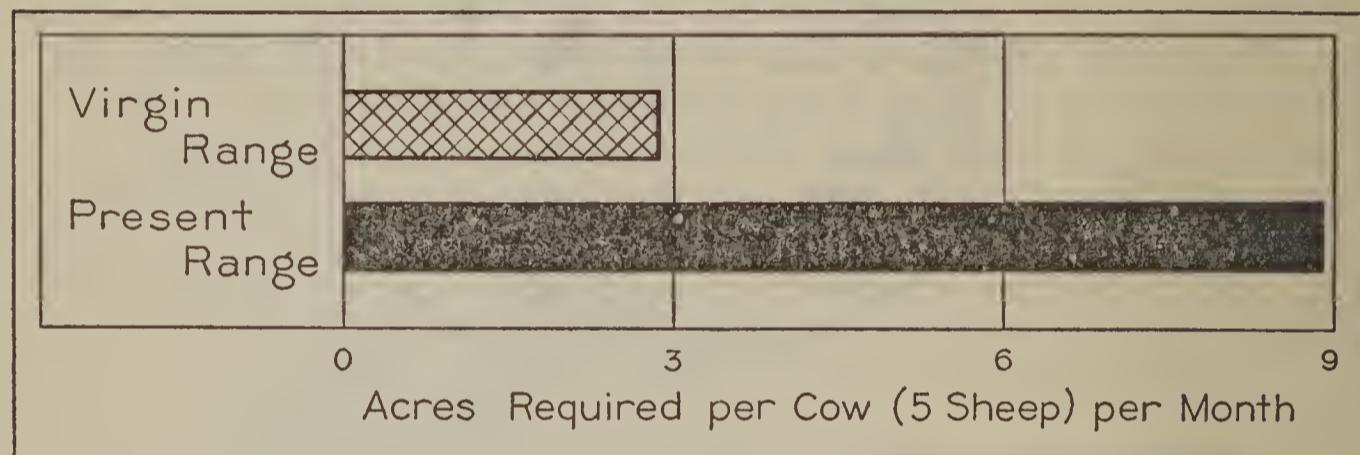


FIGURE 31.—Grazing capacity in the sagebrush-grass type has fallen so low that more than three times the acreage per cow is needed today that was required a century ago.

The virtual wrecking of this valuable resource can be traced directly to the apparent indifference of those controlling the use of the land. As shown in table 12, 93 percent of the public domain and 91 percent of the private areas of sagebrush exhibit severe or extreme forage depletion. And 81 percent of the entire sagebrush type is in these two ownerships.

Although the forage of this type already is greatly depleted, still further deterioration can be expected, for estimates based on detailed studies over a large part of the sagebrush-grass range indicate that on about 90 percent forage depletion is continuing (tables 24 and 25, pp. 115 and 116). Only immediate and drastic changes in existing policies for handling grazing on these ranges will prevent destruction of the remaining forage.

SOUTHERN DESERT SHRUB

The southern desert-shrub type (fig. 30) has been of less importance than other types in the development of the range industry.

Scant rainfall and extremely high temperatures have made most of the type a desert with practically no dependable feed for livestock. Only about 27 million of the 51 million acres in this type is usable range and most of this can be used for but a few weeks in favorable years. The practice is to use the range whenever feed and stock water are available, thereby reserving adjoining ranges or saving the expense of hay, cottonseed cake, and other supplemental feed. To this extent, the southern desert-shrub type is of some local importance.

More than half of the type is still in public ownership, chiefly as unreserved public domain. The private land is concentrated in irrigation projects such as the lower Rio Grande development in New Mexico, and the Salt River Valley project of central Arizona. Many attempts have been made to raise livestock in the southern desert-shrub type, but without irrigation these have often failed. The sagging ruins of windmill towers and the sunbleached boards of tumbling shacks are all that remain to tell the story of efforts that quickly destroyed themselves.

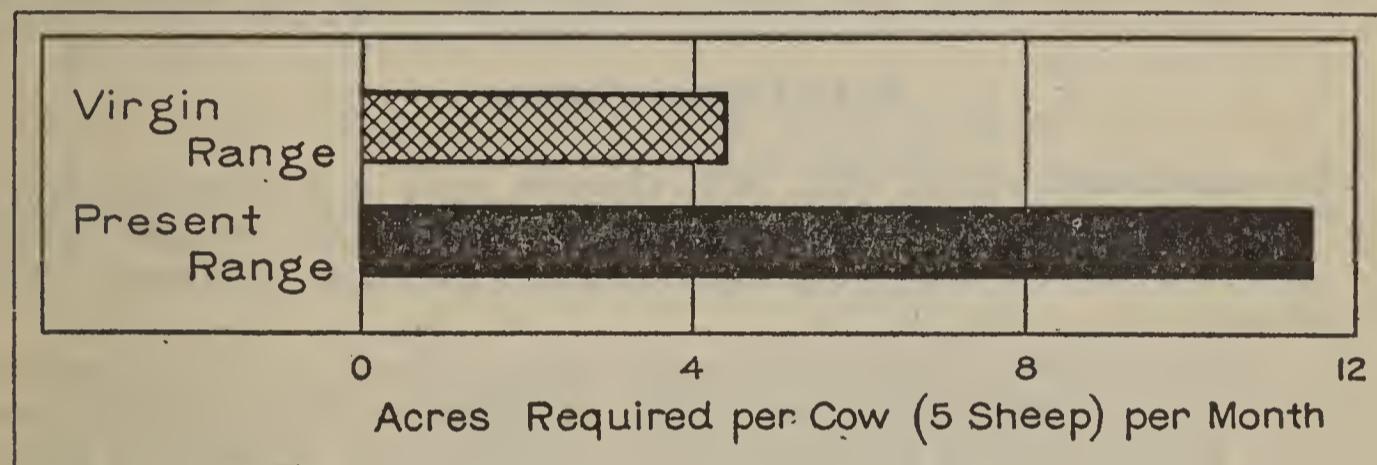


FIGURE 32.—Where $4\frac{1}{2}$ acres per cow sufficed on the original southern desert-shrub range, grazing capacity has so fallen off that nearly 12 acres are required today.

Even in its virgin condition, dependable forage production in this type was low and was restricted to small areas of grassland in drainage ways, depressions, and flood plains. Most of the grass on these alluvial areas has been destroyed. Worthless shrubs such as creosotebush, tarbush, and mesquite are rapidly taking possession of the remaining grass areas. The only abundant forage production of the desert is the luxuriant growth of winter and spring annuals which flourish in favorable years. At such times, alfileria, Indian-wheat, bur-clover, milkvetch, and sixweeks fescue carpet the desert valleys. Most important of all is alfileria, which appeared about 1870 along the freighting and stage routes in southern Arizona.

Examinations on the Rio Grande watershed indicate that near the upper limits of the type the original plant cover was composed of grasses and of weeds and browse in the ratio of about 4 to 1, whereas the plant cover of the present range in that locality now has 77 percent weeds and browse and only 23 percent grass. Moreover, the cover of the present range is only about one-third as thick as that of the virgin range. The result, as expressed in grazing capacity, is a great loss in range values, as shown in figure 32.

About 81 percent of the usable southern desert-shrub range is severely or extremely depleted (table 13). On the relatively small

accessible grazing area of the type, forage depletion has proceeded so far, and climatic conditions are so severe, that restoration of the range will be exceedingly difficult and very slow.

TABLE 13.—*Depletion of virgin range in the southern desert-shrub type by ownership and depletion classes*

Ownership or control	Moderate depletion (0-25 percent)	Material depletion (26-50 percent)	Severe depletion (51-75 percent)	Extreme depletion (76-100 percent)	All depletion classes					
Federal:										
National forests-----	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent		
Indian lands-----	0	0	50	51	8	40	98	100		
Public domain—grazing districts-----	0	0	0	0	97	78	3	2,409	100	
Other Federal-----	0	0	1,363	21	56	1,467	23	6,424	100	
All Federal-----	0	0	0	0	85	230	15	1,530	100	
State and county-----										
Private-----	0	0	1,413	14	7,233	69	1,815	17	10,461	100
All ownerships-----	0	0	1,252	22	4,300	74	240	4	5,792	100
	0	0	2,343	22	5,548	52	2,752	26	10,643	100
	0	0	5,008	19	17,081	63	4,807	18	26,896	100

SALT-DESERT SHRUB

The salt-desert shrub (fig. 30), though only a moderately productive range type, is important because it provides winter range for about 6,000,000 sheep in Utah, central Nevada, Colorado, and Wyoming.

The present area of the salt-desert range, about 41,000,000 acres, is essentially the same as under virgin conditions. The alkaline subsoil has prevented the encroachment of adjoining vegetation types and, as the low productivity of the soil and the scanty rainfall have discouraged settlers from utilizing the land for crops, most of the salt-desert type is still used as open range. Ownership, as in the virgin range, rests largely with the Federal Government as unreserved public domain.

Although the salt-desert-shrub type has changed but little in area or ownership, it is by no means in its virgin forage condition. Some of the main forage plants have almost disappeared from the type and have been replaced by unpalatable species. The extermination of valuable grasses and shrubs and their replacement by inferior species is especially evident on some of the valley plains. Here on the somewhat damper soils of the bottomlands, the once abundant giant wild-rye has been almost entirely replaced by nearly worthless greasewood. On the much more extensive, drier, and less saline soils of the valley plains the valuable ricegrass and dropseed have been so extensively killed out that they probably can be restored only by artificial reseeding. Except for a few fringes, vast areas of the palatable and nutritious winterfat, or "whitesage", have been replaced by shadscale and little rabbitbrush. In the Red Desert region of southwestern Wyoming the almost worthless rabbitbrush and snake-weed have displaced valuable forages on large tracts and are rapidly

dominating many other parts of the range. Thus, while remnants of the virgin range have an average of only 59 rabbitbrush and 41 snakeweed plants per 2,000 square feet, heavily grazed areas of the present range have 193 rabbitbrush and 196 snakeweed plants per 2,000 square feet of range, or virtual domination of the plant cover by these worthless species.

Besides having a smaller proportion of valuable forage plants, the plant cover on the salt-desert ranges is thinner now than in pioneer days. An analysis of over 1,700 sample plots indicates that the plant cover of the present range averages in western Utah only 55 percent, in central Nevada 78 percent, and in southwestern Wyoming about 67 percent as dense as that on small remnant areas of virgin or lightly grazed ranges.

The recent drought is responsible for a part of the current reduction in plant density but is not as serious a factor in range depletion as is commonly assumed. Investigations in southwestern Wyoming and in western Utah show conclusively that during the 1931-35 drought from 3 to 10 times as many plants have died on heavily grazed areas as on nearby ungrazed or very lightly grazed portions of the range (table 14) (136).

TABLE 14.—*Death losses of valuable forage plants in the salt-desert-shrub type during the 1931-35 drought*

Species	Western Utah		Southwestern Wyoming	
	Lightly grazed	Heavily grazed	Lightly grazed	Heavily grazed
	Percent	Percent	Percent	Percent
Ricegrass	24	89		
Winterfat	11	67	11	31
Bud sagebrush			5	40
Nuttall saltbush			2	20

Forage values, because of these several aspects of plant depletion, have shrunk greatly in the salt-desert-shrub type. The average forage values on Nevada ranges are estimated to be only 49 percent of those on areas protected from grazing; in Utah, 36 percent; and in southwestern Wyoming, 43 percent. Resident stockmen who have operated from 12 to 55 years on this range type estimate that the present open range is as much as 80 percent less valuable as forage than it was half a century ago. Of the 41 million acres in the salt-desert-shrub type, almost 90 percent has less than half the forage value of the virgin salt-desert range (table 15). The relation of land ownership to the status of range depletion in the salt-desert type is clearly indicated in this table. It is significant that 75 percent of the type is public domain and that 90 percent of the public-domain area is severely or extremely depleted. Grazing capacity in this type has been reduced relatively more than in any of the other types, as indicated in figure 33.

TABLE 15.—*Depletion of virgin range in the salt-desert-shrub type, by ownership and depletion classes*

Ownership or control	Moderate depletion (0-25 percent)		Material depletion (26-50 percent)		Severe depletion (51-75 percent)		Extreme depletion (76-100 percent)		All depletion classes	
	<i>1,000 acres</i>	<i>Per-cent</i>	<i>1,000 acres</i>	<i>Per-cent</i>	<i>1,000 acres</i>	<i>Per-cent</i>	<i>1,000 acres</i>	<i>Per-cent</i>	<i>1,000 acres</i>	<i>Per-cent</i>
Federal:										
National forests-----	181	49	178	49	7	2	0	0	366	100
Indian lands-----	5	(1)	708	43	894	54	50	3	1,657	100
Public domain—grazing districts-----	0	0	3,157	10	13,876	45	13,624	45	30,657	100
Other Federal-----	25	1	125	6	200	10	1,650	83	2,000	100
All Federal-----	211	1	4,168	12	14,977	43	15,324	44	34,680	100
State and county-----	0	0	21	2	250	27	656	71	927	100
Private-----	61	1	140	3	2,374	45	2,677	51	5,251	100
All ownerships-----	271	1	4,329	10	17,601	43	18,657	46	40,858	100

¹ Less than 0.5 percent.

During the past 30 years the forage values on over 85 percent of the type have been declining, and the present trend also is downward (tables 24 and 25, pp. 115 and 116). As indicated in table 25, only 1 percent of the type is exhibiting any appreciable improvement in forage values.

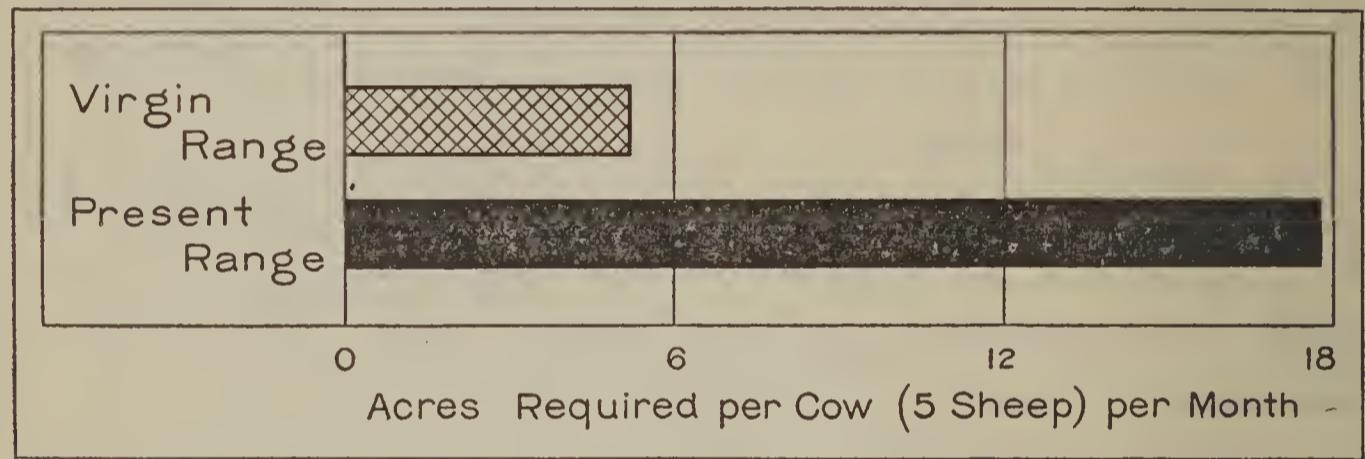


FIGURE 33.—The greatest falling-off in grazing capacity is to be found in the salt-desert-shrub type, where more than three and one-half times the acreage per cow is now required.

PIÑON-JUNIPER

The piñon-juniper type extends as far north as south-central Oregon, but is of value for forage mainly in Arizona, New Mexico, and southern Colorado (fig. 34). It is much used for spring-fall range and in some places as winter range, for which it is valuable because its grasses cure naturally on the stalk and because the trees afford protection to livestock.

There has been very little change in the total area of the piñon-juniper type during the past century. The rocky slopes and flat-topped mesas on which it is commonly found are not adapted to crop agriculture, and very little of the original piñon-juniper type has been diverted to agricultural crops. Three-fourths of the 76 million acres in the present piñon-juniper range is divided among public domain, national forests, and private holdings.

On two-thirds of this type the forage is either materially or severely depleted, and on an additional fourth it is extremely depleted (table 16). This loss in forage value probably has resulted

from a general thinning of the herbaceous cover rather than from extensive changes in its composition. For example, on piñon-juniper ranges of the upper Rio Grande watershed in New Mexico, grasses which originally made up about 80 percent of the herbaceous cover still hold this position, except on the most severely depleted areas.

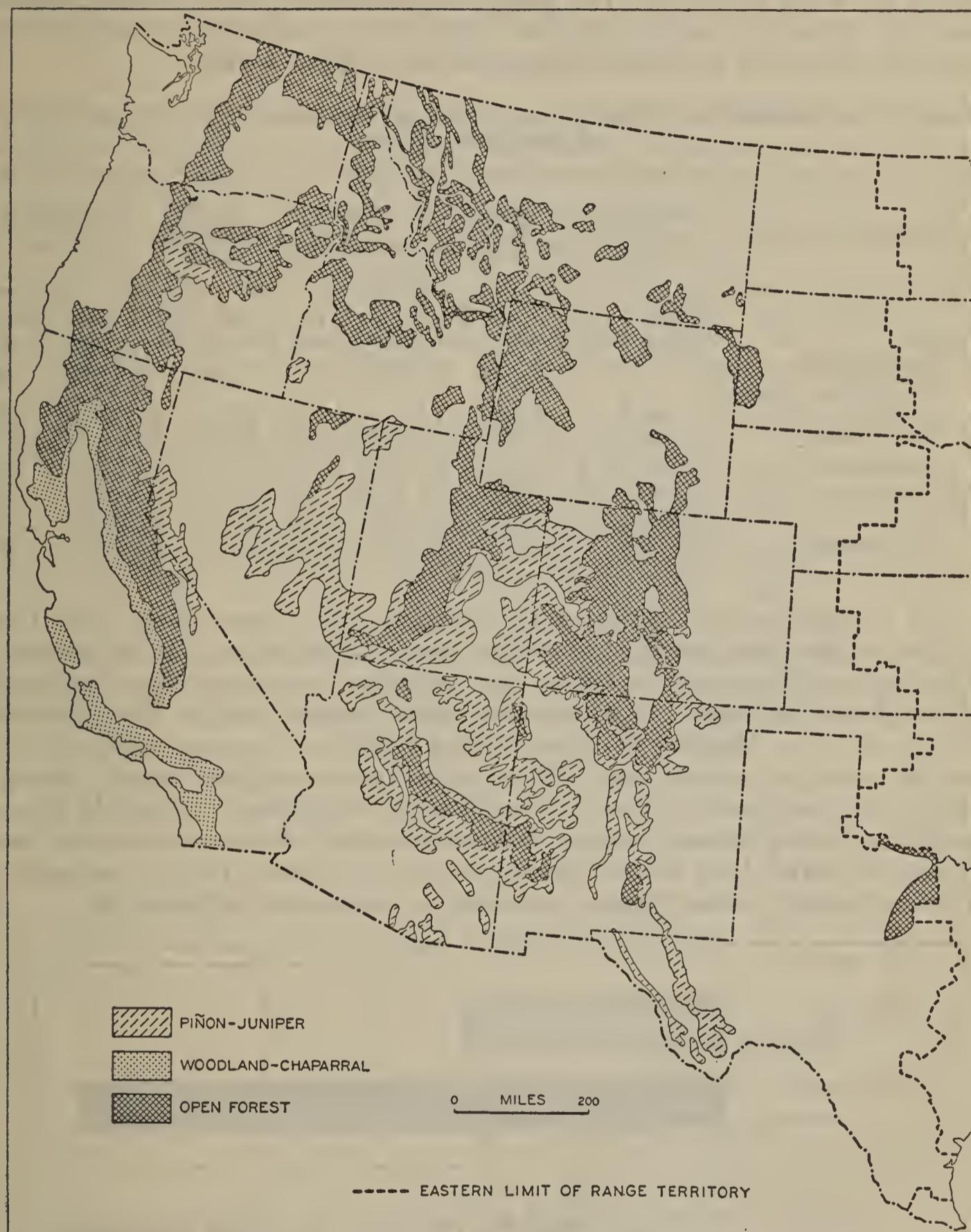


FIGURE 34.—THE PRINCIPAL FOREST TYPES OF THE PRESENT RANGE.

Much of the open-forest type is on the national forests. Woodland-chaparral is wholly a California type.

The average density of this herbaceous vegetation, however, is in that region less than half what it was in the virgin condition. The more northerly piñon-juniper ranges probably had a thin cover of herbaceous vegetation even before the white man began to use those ranges and, with long-continued and excessive use, the forage plants

have practically vanished from many portions of the type in Nevada, Utah, and Oregon. There is also little doubt that the general thickening of the tree stand throughout the type has still further reduced the area which can be occupied by herbaceous plants. Many of the small grassy "parks" characteristic of the type have filled up with trees, and the junipers frequently have taken possession of meadows adjoining the type, thus gradually reducing the amount of space available for grass and other forage.

TABLE 16.—*Depletion of virgin range in the piñon-juniper type, by ownership and depletion classes*

Ownership or control	Moderate depletion (0-25 percent)	Material depletion (26-50 percent)	Severe depletion (51-75 percent)	Extreme depletion (76-100 percent)	All depletion classes
Federal:					
National forests-----	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres
3,462	25		5,581	41	599
Indian lands-----	132	1	1,248	12	758
Public domain—Grazing districts-----	398	2	2,022	9	8,948
1,500	300			40	10,934
Other Federal-----	25	1		33	2,736
All Federal-----	4,017	8	9,151	18	15,027
State and county-----	309	8	958	25	682
Private-----	1,652	8	6,332	30	8,675
All ownerships-----	5,978	8	16,441	22	32,188
				42	21,121
					28
					75,728
					100

As a result of the general thinning of the plant cover and the rather widespread shrinkage in the area available for the herbaceous vegetation between the trees, the grazing capacity has declined throughout the type. On heavily used ranges in the Rio Grande Basin of New Mexico, it is estimated that the grazing capacity is, on the average, only about half of what it was originally, and many ranges in that locality show a loss of over 80 percent. Severely overgrazed piñon-juniper ranges in south-central Arizona also are believed to have lost about three-fourths of their grazing capacity. The reduction in the type as a whole is indicated in figure 35.

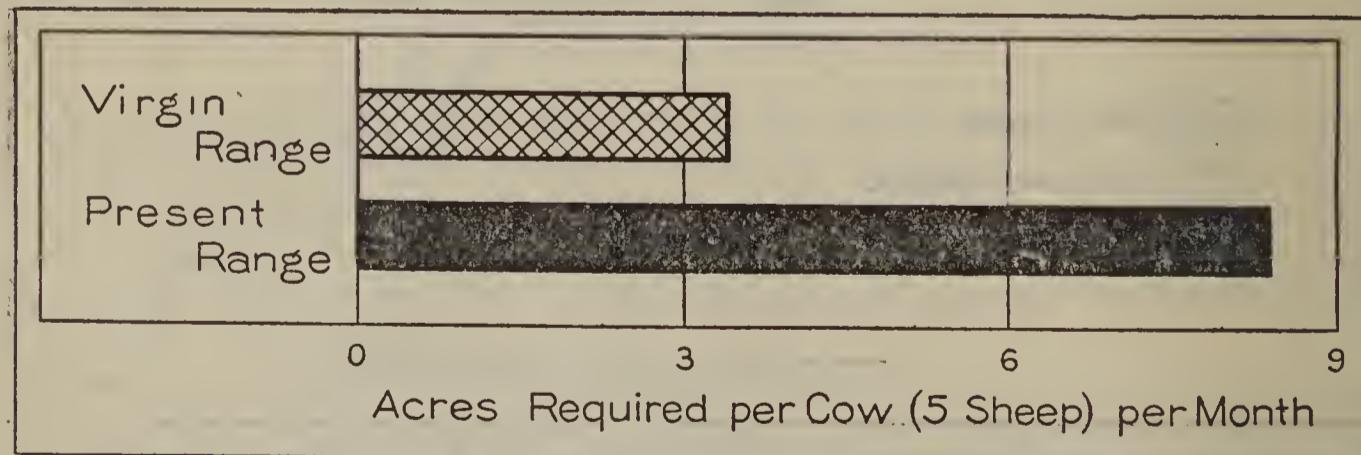


FIGURE 35.—Estimated grazing capacity of the piñon-juniper type under virgin-range conditions has been reduced by more than half.

The most widespread and serious forage depletion in the piñon-juniper type is, as shown in table 16, on the public domain, Indian lands, and privately owned ranges. Under these three forms of control more than half of the entire area of the piñon-juniper type has lost from 50 to 100 percent of its forage value.

This reduction in forage values is not a recent development. During the last 25 or 30 years nearly three-fourths of the piñon-juniper type has steadily deteriorated as a forage resource (table 24, p. 115). During this period scarcely one-fifth of the total area in the type has shown any improvement whatever, and practically all of this is on the national forests of the Southwest.

WOODLAND-CHAPARRAL

The woodland-chaparral type occurs chiefly in California, where it forms a transition zone between the grassy pastures and crop lands of the Great Central Valley and the timbered areas of the higher mountains; it also covers extensive areas in the coast ranges (fig. 34.) The lower portions of this type are open woodlands containing valuable forage and are much used for fall, winter, and spring grazing. The upper portions are mostly chaparral, impenetrable thickets of brush of low value or unfit for grazing but extremely valuable in watershed protection and in preventing flood damage to lower areas.

In California the type is estimated to cover about 19 million acres, of which approximately 13.4 million acres are open to grazing. The type has increased about 3.5 million acres during the past century. About 70 percent of this expansion has been at the expense of adjoining areas of commercial timber, as a result of fire and logging. Ownership of the present woodland-chaparral range is largely private, only about 20 percent being in public ownership.

The make-up of the herbaceous plant cover in this type has undergone tremendous changes within the past century. More than 30 years ago, at least one valuable forage plant, California oatgrass, had become scarce in certain parts of the type (42). Other good forage plants, such as needlegrass and oniongrass are now much less abundant. Partially replacing the plants lost from the type are three valuable immigrants which have appeared in considerable quantity: *Alfileria*, slender oat, and bur-clover. Unfortunately, most of the other immigrant plants are of very little value as feed for livestock and at least one of them is poisonous. St. Johnswort, or "Klamath weed", an aggressive and poisonous introduced plant, was first observed by stockmen about 1900 and is now estimated to have spread over more than 100,000 acres of California grazing lands in this and adjoining types (117). Other uninvited guests, more especially foxtail chess, ripgut grass, and other species of chess or "cheatgrass" having stiff beards (awns), mature early and, because of mechanical injury, force the removal of sheep from many parts of the range. The prevalence of foreign plants in this range type was strikingly illustrated by a survey in the San Joaquin Valley where on 907 sample plots, the exotic plants were found to make up 59 percent of the plant cover in the woodland portions of the type and 51 percent in the chaparral.

Extensive replacement of good forage plants by species of little or no forage value has occurred throughout the type. On a small ungrazed area near Sonora, Calif., it was found that 95 percent of the grasses and herbs originally present were palatable and nutritious, whereas only 36 percent of the grasses and herbs on adjacent grazed areas are suitable for feed (table 17). A survey in the

woodland portion of the type in the San Joaquin Valley gave still further evidence of the replacement of valuable perennials by inferior annual grasses and weeds: Sample plots on ungrazed areas there have an average of about 69 percent perennial and 31 percent annual plants, but plots on typical nearby grazed areas indicate that the herbaceous vegetation of the present range has only 2 percent perennials but 98 percent annuals.

The herbaceous plant cover is, over most of the type, as thick now as it was before the range was used by domestic livestock. As has been noted, new plants have come into the type in sufficient numbers to replace completely those which have disappeared. Even though the herbaceous cover is as thick as formerly, however, the total area available for grazing is smaller because existing brush thickets have expanded and new ones have appeared. Thus, the decline in grazing capacity shown in figure 36 is attributable both to the smaller percentage of valuable forage plants and to the smaller area available for forage production.

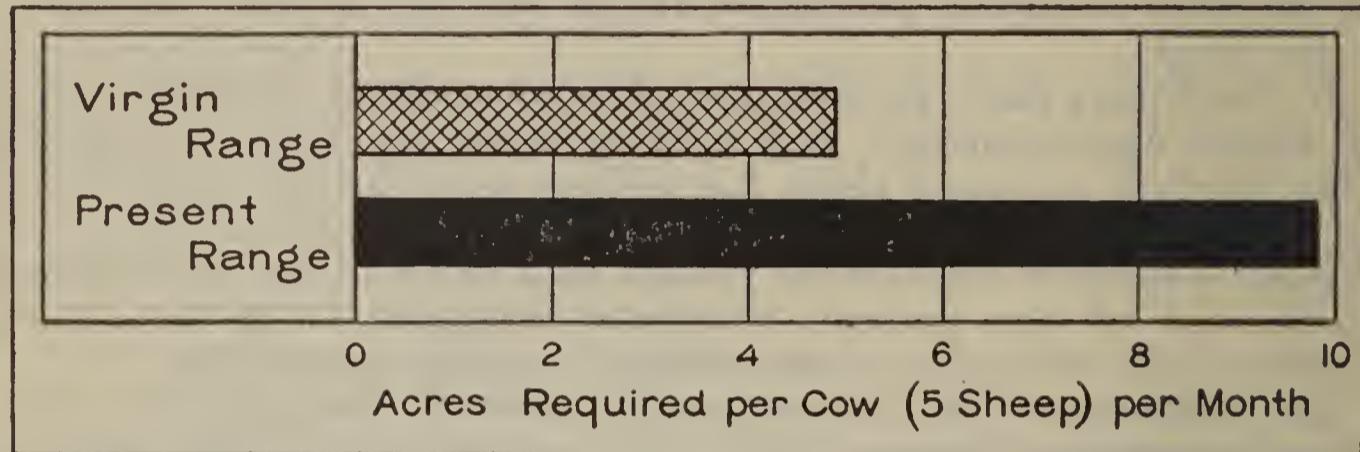


FIGURE 36.—Reduction in grazing capacity in the woodland-chaparral type since pioneer days is estimated at 50 percent.

TABLE 17.—*Approximate composition of the herbaceous cover on virgin and present ranges in the woodland-chaparral type*

Composition	Small remnant of the virgin range		Present (grazed) range
	Percent	Percent	
Perennial grasses (good forage).....	90	0	
Annual grasses and herbs:			
Good forage.....	5	36	
Poor or worthless forage.....	5	64	
Total.....	100	100	

It is estimated that the forage is severely depleted on fully one-half of the present woodland-chaparral range, and at least materially depleted on the remainder (table 18). Moreover, depletion is continuing on about three-fourths of the type (tables 24 and 25). This depletion results chiefly from the grass and brush fires which sweep across the foothill country. Woodland-chaparral ranges in all ownerships have suffered alike from fire. Even though most of these ranges are privately owned, high watershed and wildlife values of the type are of great public importance and concerted public and private action is needed to exclude fire from the woodland-chaparral ranges.

TABLE 18.—*Depletion of virgin range in the woodland-chaparral type by ownership and depletion classes*

Ownership or control	Moderate depletion (0-25 percent)		Material depletion (26-50 percent)		Severe depletion (51-75 percent)		Extreme depletion (76-100 percent)		All depletion classes	
	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent
Federal:										
National forests.....	12	2	500	70	200	28	0	0	712	100
Indian lands.....	0	0	72	92	6	8	0	0	78	100
Public domain—grazing districts.....	0	0	796	47	897	53	0	0	1,693	100
Other Federal.....	0	0	60	50	60	50	0	0	120	100
All Federal.....	12	(1)	1,428	55	1,163	45	0	0	2,603	100
State and county.....	0	0	83	51	80	49	0	0	163	100
Private.....	150	1	4,826	45	5,490	52	174	2	10,640	100
All ownerships.....	162	1	6,337	48	6,733	50	174	1	13,406	100

¹ Less than 0.5 percent.

OPEN FORESTS

Open forests are a prominent part of the grazing resource. These forests of more or less widely spaced trees with intermingled grassy meadows and browse thickets comprise the second largest (126 million acres) of all the range types (fig. 34) and the most widely distributed. It includes such diverse forms as nearly pure stands of ponderosa pine, ponderosa pine with sugar pine or Douglas fir, aspen and fir, spruce and fir, alpine grasslands, and mountain brush. Much of it occurs on steep hillsides. Although used to some extent as spring-fall range, the open-forest type is preeminently a summer range. Much of it lies at high altitudes where the snow remains late in the spring and forage generally does not become available to livestock as early as in other range types. Portions of the type which lie at lower elevations ordinarily are used for spring-fall range.

Of the 126 million acres of open-forest range, about half is in large blocks under national-forest supervision and a little more than a third is in much smaller, more widely scattered privately owned units.

Forage depletion in the open-forest type has resulted, as in other range types, from the replacement of good forage plants by poor ones, and from a general thinning of the herbaceous cover. In addition, the development of dense thickets of young trees or brush, desirable as this may be for timber production or watershed protection, has reduced the area available for forage plants.

The most serious forage depletion is on the numerous grassy meadows scattered through the type, which, though relatively small in total area, formerly had a very large part of the best forage. Replacement of palatable species by plants of inferior grazing value is especially evident here. On representative forest meadows in Oregon and Washington where tufted hairgrass originally was 90 percent of the ground cover, it is now only 50 percent, having been replaced by dandelion, knotweed, and senecio. In the ponderosa pine forests of the Coconino Plateau in Arizona, grasses are 90 percent and unpalatable weeds 2 percent of the herbaceous cover on lightly grazed meadows, whereas on heavily grazed areas grasses are

only 10 percent and unpalatable weeds 75 percent of the cover. On some forest meadows of Montana, redtop, alpine bluegrass, sheep fescue, oatgrass, gentian, and alpine willows have dwindled in numbers, giving way to weeds of low palatability. In the ponderosa pine forests of Montana and northern Idaho it is reported that such forage grasses as wheatgrass, Idaho fescue, and bluegrass are scarcer, and that downy chess ("cheatgrass") and inferior weeds are increasing. In the Southwest, mountain-mahogany, cliffrose, and other highly palatable browse species are being replaced in many places by the much less palatable manzanita and skunkbush.

Likewise the greatest changes in the density of the herbaceous cover have occurred in the forest meadows, "parks", and alpine grasslands. Cattle congregate on such areas and, because feed is more abundant and herding easier, it is difficult to prevent overuse by sheep. In some parts of the ponderosa pine forests of northern Arizona it is estimated that the herbaceous cover on these mountain parks is only 45 percent as thick as on similar areas where livestock have not congregated. An analysis of results obtained by measuring the herbaceous cover on nearly 1,200 plots in the open forests and mountain meadows of Colorado and Wyoming indicates the following reductions in density of plant cover:

Reduction from density of virgin range:	Percent
Open lodgepole pine	11
Ponderosa pine	21
Alpine meadows	34
Aspen forests	45
Oak brush	45

In some parts of the type the density of the herbaceous cover has been reduced to practically nothing through development of dense thickets of pine reproduction. These thickets vary from a few square feet to several acres in size and effectively shade out the herbaceous plants. Thus, although the total acreage classified as open-forest type may remain constant, the net area available for forage plants may be considerably smaller. On the Sitgreaves National Forest in Arizona, it is estimated that the development of dense pine thickets on some parts of that forest has been an important factor in reducing the grazing capacity of that range fully 25 percent in the last 20 years. Dense thickets of young pine trees frequently occur on logged-over areas of ponderosa pine forests and reduce the amount of space available for forage production as do similar thickets in the uncut forests. Expansion of brush on logged-over areas also materially decreases the space available for herbaceous plants. A notable example is the 10-mile advance on a 30-mile front of chaparral thickets on cut-over pine lands in Eldorado County, Calif. (184). These trees and brush thickets are, however, highly desirable for maintenance of the timber supplies and for watershed protection and it should also be appreciated that the loss in forage may be merely temporary while the trees are attaining maturity.

The net result of increased numbers of inferior species, less density of vegetation, and the incursion of thickets is expressed in the reduced grazing capacity shown in figure 37.

Forage conditions on the open-forest range as a whole are better than in any other type except the tall-grass (table 21, p. 111). But these conditions vary widely with ownership. As shown in table 19, forage depletion has reached an advanced stage under some forms of ownership or land management. About one-half of the type is in the national forests, and a majority of the national-forest ranges have less than 25-percent forage depletion. Forest ranges under other forms of Federal control are, as shown in table 19, largely de-

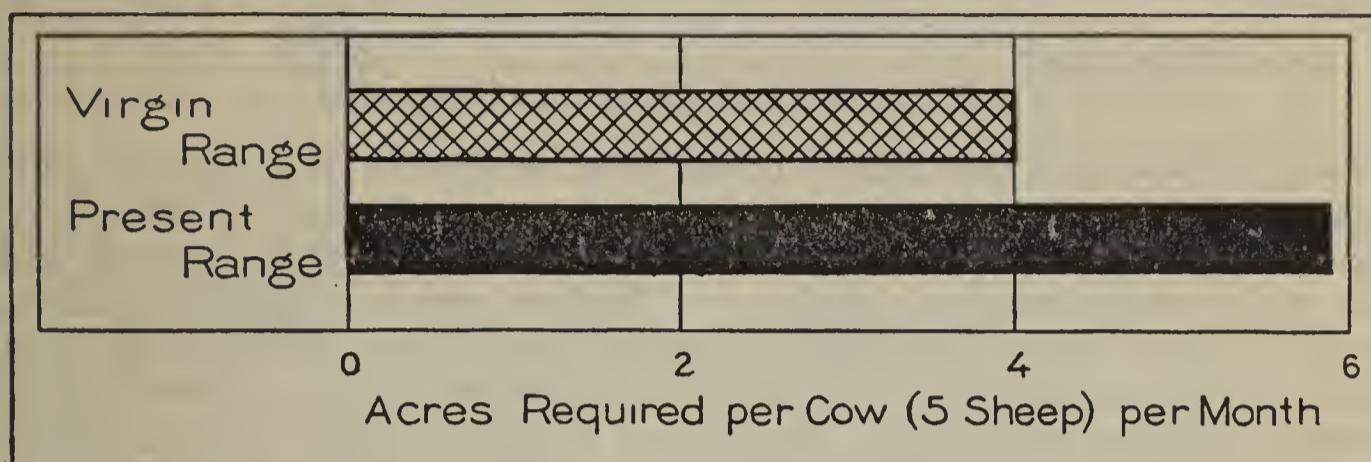


FIGURE 37.—Estimated original and present grazing capacity in the open-forest type, where nearly half again the range area per animal unit is now required.

pleted materially or worse. About one-fourth of the privately owned forest ranges and about the same proportion of State and county lands in this type are in reasonably good condition.

TABLE 19.—*Depletion of virgin range in the open-forest type by ownership and depletion classes*

Ownership or control	Moderate depletion (0-25 percent)		Material depletion (26-50 percent)		Severe depletion (51-75 percent)		Extreme depletion (76-100 percent)		All depletion classes	
	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent
Federal:										
National forests-----	35,670	55	24,349	37	4,412	7	354	1	64,785	100
Indian lands-----	1,441	20	4,437	62	1,156	16	156	2	7,190	100
Public domain—grazing districts-----	581	13	749	17	2,194	51	811	19	4,335	100
Other Federal-----	100	6	857	49	773	44	9	1	1,739	100
All Federal-----	37,792	48	30,392	39	8,535	11	1,330	2	78,049	100
State and county-----	1,250	26	2,081	44	1,103	23	316	7	4,750	100
Private-----	12,116	28	20,188	46	9,073	21	2,191	5	43,568	100
All ownerships-----	51,158	40	52,661	42	18,711	15	3,837	3	126,367	100

The close connection between ownership and degree of forage depletion is illustrated by a recent survey in the open forests of Colorado, Wyoming, and the Black Hills of South Dakota. Detailed studies on nearly 1,200 sample plots (table 20) indicate that the average loss in forage values from virgin forage conditions is as follows: Lands under national-forest management, 25 percent; privately owned ranges, 41 percent; and public domain, 63 percent. It should be noted that these average relationships also hold for smaller portions of the type, indicating that form of management rather than local variation in the type itself is responsible for these large differences in forage depletion.

TABLE 20.—*Decline in range forage value as related to ownership (or control) of range lands in the open-forest type in Colorado, Wyoming, and South Dakota*

Type	National forest	Private	Public domain
	Percent	Percent	Percent
Ponderosa pine.....	21.8	29.2
Alpine meadows.....	20.2	58.6
Aspen forests.....	31.6	71.9
Oak brush.....	17.4	56.7	63.3
Average loss (weighted).....	25	41	63

Such differences are likely to be even larger in the future. The national-forest ranges, when placed under management in 1905, were for the most part in about the same condition as other public and privately owned ranges are today. Before creation of the national forests these areas were "free range" and were misused by local stockmen in much the same way as the present unreserved public domain. Early records of the Forest Service, amply substantiated by statements of local residents, describe many national-forest ranges in this type as being little better than "dust beds" almost devoid of forage plants. Although these national-forest ranges are not yet restored to full grazing capacity, the remarkable improvement which has been obtained during the past 30 years proves that with systematic management the remaining open-forest ranges now in poor condition can be reclaimed. It is estimated that nearly 60 percent of the open-forest type has shown appreciable improvement during the past quarter century but that the forage values on about 25 percent are being still further decreased (table 24, p. 115). During the past 5 years, as shown in table 25 (p. 116), the recent unprecedented drought (abetted probably by other factors) has caused a temporary shift in trends, and only about 35 percent of the open-forest ranges are at present thought to be improving in forage value.

UNGRAZED AREAS

Of the 974,548,480 acres gross area of the present western range country, over 245 million cannot be used for grazing. Of these, 68 million acres are in dense forests;¹⁰ 116 million acres in farms; slightly over 2 million acres are in cities, towns, railroad, and highway rights-of-way; and 59 million acres are barren or inaccessible. In addition, about 8.4 million acres of grazable land are at present closed to grazing in order to safeguard water supplies or for other reasons.

A CENTURY'S TOLL IN "FREE USE" OF THE RANGE

The figures given in table 5 indicated radical changes in area and ownership throughout the range area, but even more sweeping than these are the changes that have occurred in the forage resource itself,

¹⁰ Several million acres of pasture in the dense forest type are not included in this 68 million acres. The total area of these pastures is so small that a separate type classification could not be established and they are included therefore in other range types.

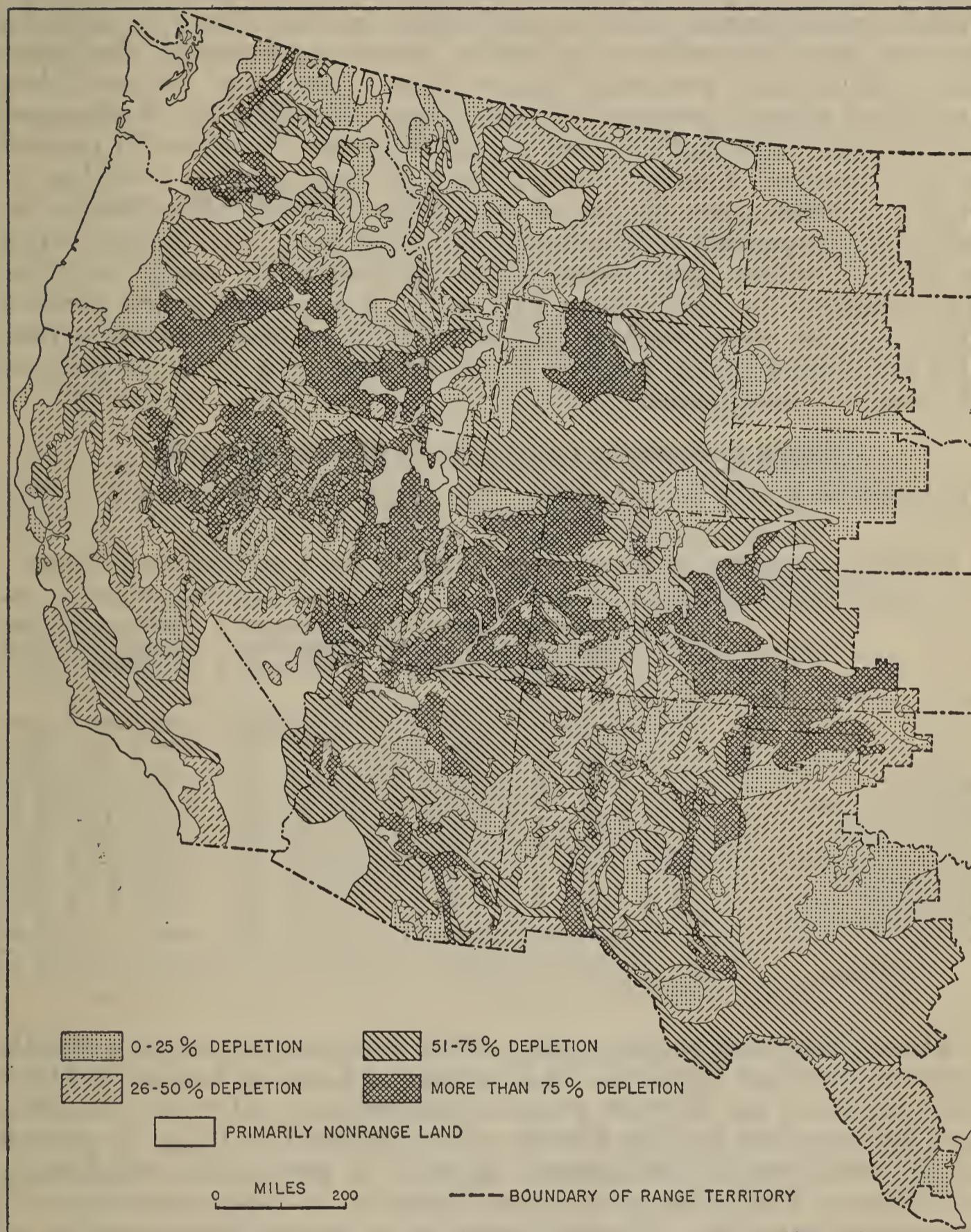


FIGURE 38.—DEGREE AND EXTENT OF FORAGE DEPLETION ON THE PRESENT RANGE.

Severe depletion (51-75 percent) and extreme depletion (76-100 percent) predominate throughout the West, save in the resilient tall-grass, short-grass, and Pacific bunch-grass types. (The white areas of primarily nonrange land comprise chiefly agricultural land, desert, and dense forest.)

as the foregoing type descriptions have made clear. These have involved striking adjustments in the composition of the vegetation cover. Valuable forage plants, such as bluebunch wheatgrass, giant wild-rye, and ricegrass have entirely disappeared, or almost so, from several range types; palatable plants, such as "little bluestem", buffalo grass, grama, wild-rye, and winterfat have been replaced by such unpalatable plants as snakeweed, cactus, greasewood, shadscale, and rabbitbrush; perennial grasses have given way to much less nutritious annual grasses, in some types changing the herbaceous cover from 75 percent or more perennial grasses to 60 or 70 percent annual grasses. Foreign plants, many of them nearly worthless or even poisonous, have appeared in large numbers. The forage resource of the present range also differs from that of the virgin range in that the whole plant cover is much thinner; in many instances the present cover is less than half as thick as it was a few decades ago. And, in some parts of the range, there is less soil space available for forage plants because of the development of dense thickets of brush or young trees.

FIGURE 39.—DEGREE OF DEPLETION IN FORAGE TYPES.

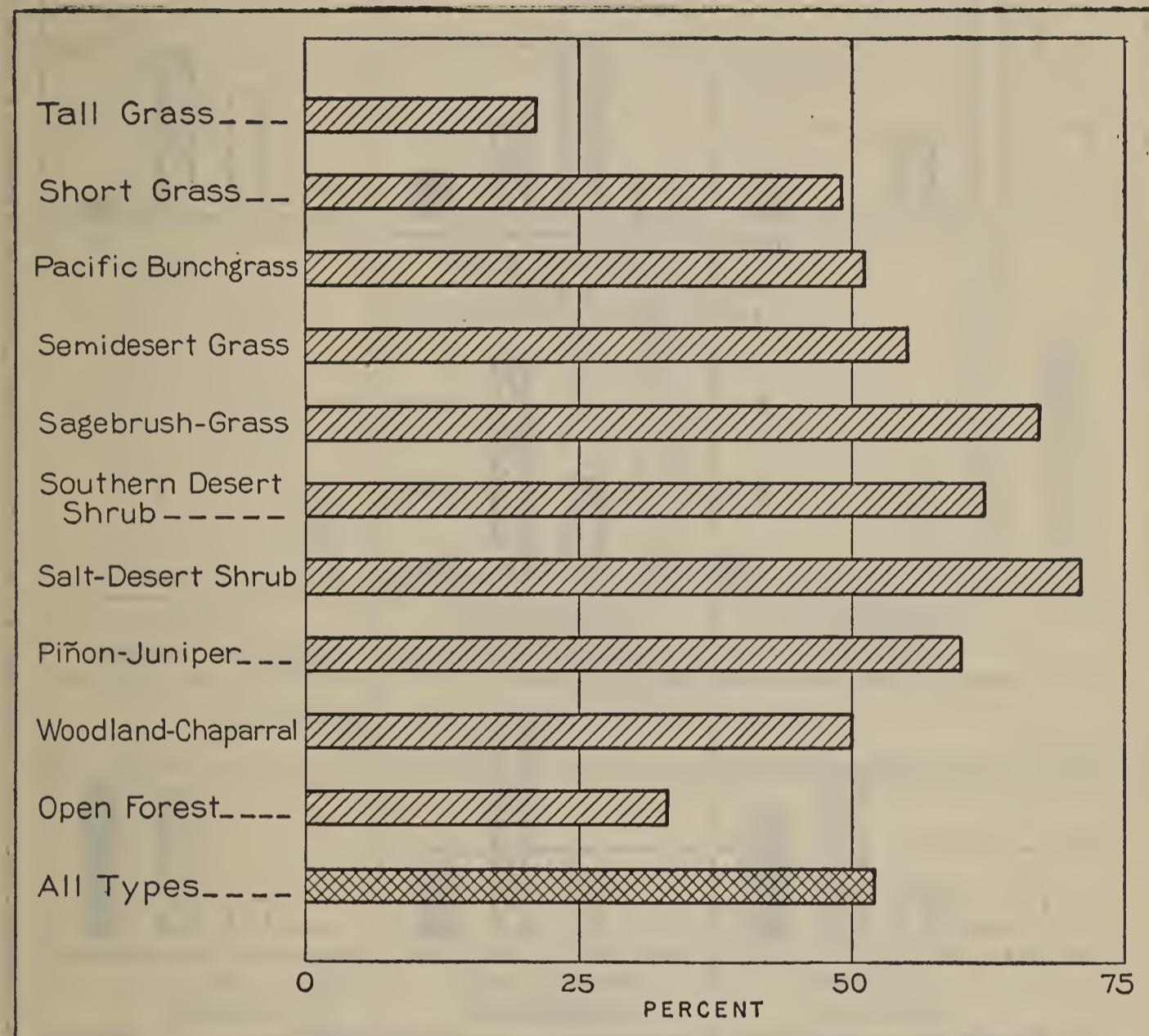
The types least depleted are the resilient tall-grass and the open-forest, half of which is in the national forests.

TABLE 21.—*Depletion of virgin range forage by types and depletion classes*

Type	Moderate de- pletion (0- 25 percent)		Material de- pletion (26- 50 percent)		Severe de- pletion (51- 75 percent)		Extreme de- pletion (76- 100 percent)		All de- pletion classes
	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent	
Tall grass.....	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres
Short grass.....	13,589	73.4	4,175	22.6	0	0	749	4.0	18,513
Pacific bunchgrass.....	16,047	8.1	101,690	51.3	54,424	27.5	25,931	13.1	198,092
Semidesert grass.....	3,484	8.2	15,592	36.7	20,721	48.7	2,737	6.4	42,534
Sagebrush-grass.....	2,317	2.6	25,268	28.3	57,363	64.3	4,326	4.8	89,274
Southern desert shrub.....	1,819	1.9	13,496	14.0	45,648	47.3	35,565	36.8	96,528
Salt-desert shrub.....	0	0	5,008	18.6	17,081	63.5	4,807	17.9	26,896
Piñon-juniper.....	271	0.7	4,329	10.6	17,601	43.1	18,657	45.6	40,858
Woodland-chaparral.....	5,978	7.9	16,441	21.7	32,188	42.5	21,121	27.9	75,728
Open forests.....	162	1.2	6,337	47.3	6,733	50.2	174	1.3	13,406
All types.....	51,158	40.5	52,661	41.7	18,711	14.8	3,837	3.0	126,367
All types.....	94,825	13.0	244,997	33.7	270,470	37.1	117,904	16.2	728,196

These changes in the character of the forage resource have greatly lessened its value (fig. 38). It is estimated that the forage on about 55 percent of the present range is severely or extremely depleted and has less than half its former value (table 21). Only 15 percent of the total area of the present range is in reasonably satisfactory condition. The relative average depletion in the range types is shown in figure 39. The tall-grass prairies, with three-fourths of their total acreage having but moderate depletion, is in the best condition of any range type (fig. 40). The open-forest type of which 40 percent is only moderately depleted, and 18 percent severely or extremely depleted, is second best. The salt-desert-shrub type apparently is in the worst condition, since on nearly nine-tenths of its total area forage values have fallen 50 to 100 percent. The southern desert shrub, the sagebrush-grass, the semidesert grass, and the piñon-juniper types are now worth forage scarcely a third of what they were a few decades ago.

The primary cause of forage depletion is poor management. For example, it is well known that the unreserved public domain has been treated as "free range", open to any number of livestock and subject to no regulations designed to maintain its productivity. As a consequence 84 percent of the public domain has lost more than half its forage value (table 22) and the entire area has been depleted an average of 67 percent (table 23). The national-forest ranges, on the



other hand, though in poor condition when put under regulation and though used continuously by large numbers of livestock have been handled so as to perpetuate and build up the forage resource. As a result of this better management, only 14 percent of these Federal grazing lands are in the severely or extremely depleted classes (fig. 41). Unfortunately, these demonstrated improvements in national-forest ranges can have but a minor influence in halting depletion on the western range as a whole, for the national-forest ranges constitute only 12 percent of the total grazable area in the West.

With destruction of the plant cover has come soil deterioration. As emphasized in another part of this report, sheet and gully erosion

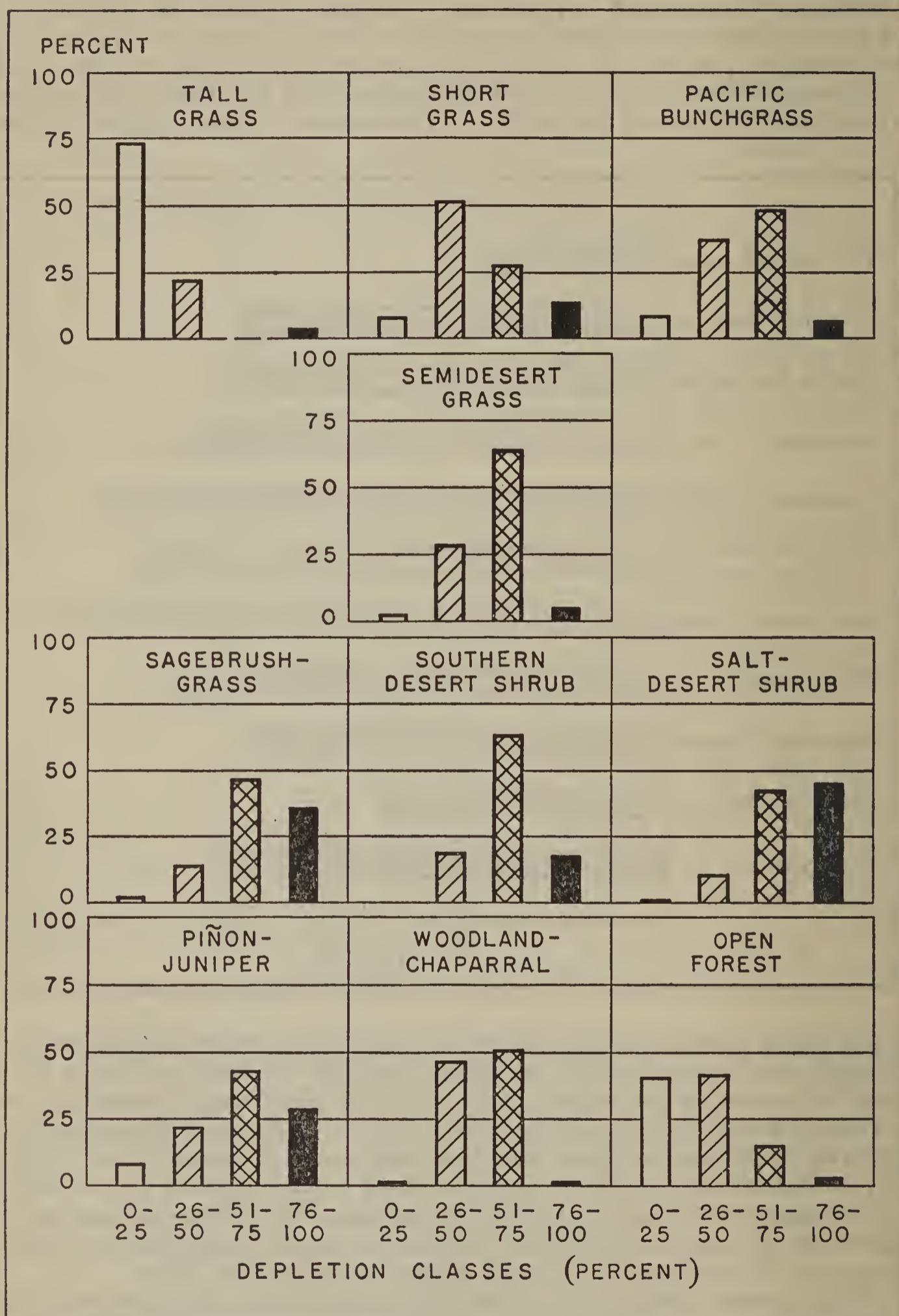


FIGURE 40.—DEGREES OF DEPLETION IN EACH TYPE.

Losses in forage values range from the very favorable condition in the tall-grass to the desperate situation in the shrub types.

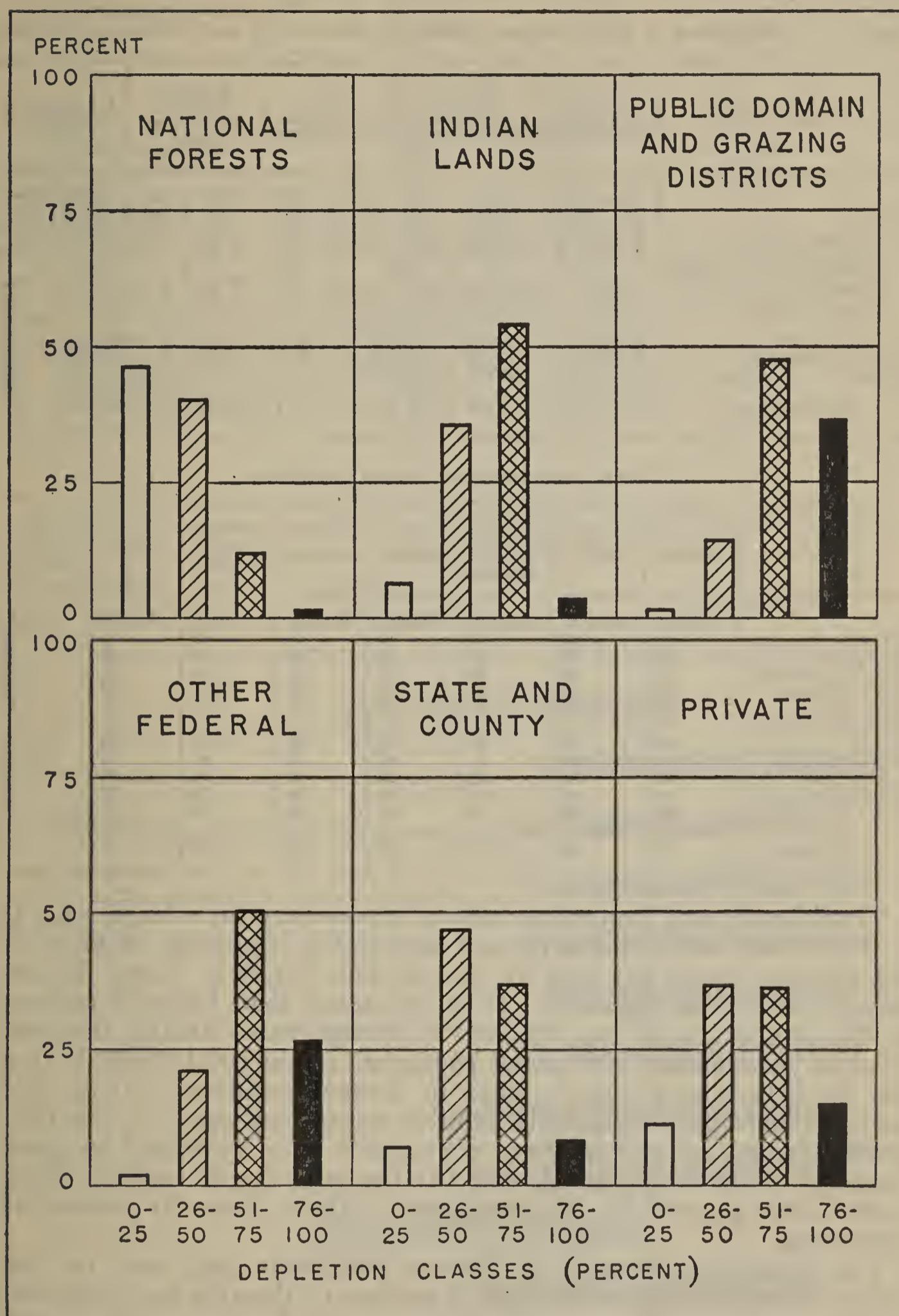


FIGURE 41.—DEPLETION IN THE DIFFERENT OWNERSHIP CLASSES

The advantages of grazing management are indicated by the small percentages of severe or extreme depletion on the national-forest ranges in contrast with other ownerships.

are appearing on many western ranges, washing away the fertile topsoil and preventing reestablishment of the plant cover.

TABLE 22.—*Depletion of virgin-range forage by ownership and depletion classes*

Ownership or control	Moderate depletion (0-25 percent)		Material depletion (26-50 percent)		Severe depletion (51-75 percent)		Extreme depletion (76-100 percent)		All depletion classes
Federal:									
National forests-----	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres	Per- cent	1,000 acres
40,897	46.5		35,172	40.0	10,553	12.0	1,332	1.5	87,954
Indian lands-----	3,171	6.6	17,328	35.8	26,128	54.0	1,764	3.6	48,391
Public domain—grazing districts-----	1,868	1.5	18,320	14.3	61,168	47.9	46,436	36.3	127,792
Other Federal-----	463	2.0	4,871	21.2	11,527	50.1	6,136	26.7	22,997
All Federal-----	46,399	16.1	75,691	26.4	109,376	38.1	55,668	19.4	287,134
State and county-----	4,676	7.1	30,909	47.2	24,209	37.0	5,722	8.7	65,516
Private-----	43,750	11.7	138,397	36.9	136,885	36.4	56,514	15.0	375,546
All ownerships-----	94,825	13.0	244,997	33.7	270,470	37.1	117,904	16.2	728,196

TABLE 23.—*Average forage depletion*

Type	National forests	Indian lands	Public domain—grazing districts	Other Federal	All Federal	State and county	Private	All ownerships
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Tall grass-----	12	20	12	12	14	12	22	21
Short grass-----	30	38	47	55	43	43	51	49
Pacific bunchgrass-----	37	70	68	59	55	54	50	51
Semidesert grass-----	53	62	58	65	60	51	54	55
Sagebrush-grass-----	40	45	71	56	66	57	71	67
Southern desert shrub-----	60	63	63	66	63	58	63	62
Salt-desert shrub-----	26	52	71	81	70	80	74	71
Piñon-juniper-----	41	61	72	76	61	64	56	60
Woodland-chaparral-----	44	39	51	50	49	50	51	50
Open forests-----	26	38	56	47	29	40	38	33
All types-----	30	51	67	63	53	49	51	52

That drastic and immediate action is necessary on a large scale is indicated not only by the present deplorable condition of most of the western range but also by the present trends in forage depletion, as shown in figure 42. It is estimated that fully 75 percent of the present range has declined in forage value during the past 25 or 30 years and on only about 16 percent of the total grazable area has there been any improvement in forage conditions during this period (table 24). The only notable exceptions are (1) the tall-grass prairies, of which about 60 percent have remained in good condition or have improved, and (2) the open-forest ranges, which have shown appreciable improvement on about 55 or 60 percent of their area.

The least improvement in forage conditions has been on the public-domain ranges, where only 2 percent of the area has improved and over 90 percent has steadily deteriorated. The greatest improvement during the past quarter century has been on national-forest ranges, of which about 77 percent are believed to have improved and forage depletion has at least been stopped on approximately 18 percent of the total area in these ranges.

TABLE 24.—*Trends in range forage depletion for approximate period 1905-35*

Type or ownership (or control)	Appreciable improvement in forage ¹		Appreciable decline in forage		Forage conditions more or less unchanged		Total area	
	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	
Tall grass-----	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	
11,239	61	6,354	34	920	5	18,513		
Short grass-----	10,446	5	185,006	94	2,640	1	198,092	
Pacific bunchgrass-----	2,637	6	35,397	83	4,500	11	42,534	
Semidesert grass-----	2,083	2	80,717	91	6,474	7	89,274	
Sagebrush-grass-----	3,420	4	87,104	90	6,004	6	96,528	
Southern desert shrub-----	44	(²)	25,911	96	941	4	26,896	
Salt-desert shrub-----	270	1	35,407	86	5,181	13	40,858	
Piñon-juniper-----	14,929	20	54,283	72	6,516	8	75,728	
Woodland-chaparral-----	653	5	10,521	78	2,232	17	13,406	
Open forests-----	72,687	58	31,970	25	21,710	17	126,367	
Total-----	118,408	16	552,670	76	57,118	8	728,196	
Federal ownership and control:								
National forests-----	67,880	77	3,885	5	16,189	18	87,954	
Indian lands-----	4,875	10	36,130	75	7,386	15	48,391	
Public domain—grazing districts-----	2,697	2	118,148	93	6,947	5	127,792	
Other Federal-----	1,532	7	18,685	81	2,780	12	22,997	
State and county-----	4,479	7	57,473	88	3,564	5	65,516	
Private-----	36,945	10	318,349	85	20,252	5	375,546	
Total-----	118,408	16	552,670	76	57,118	8	728,196	

¹ Includes also those areas in satisfactory condition at beginning of period which are unchanged in condition.

² Less than 0.5 percent.

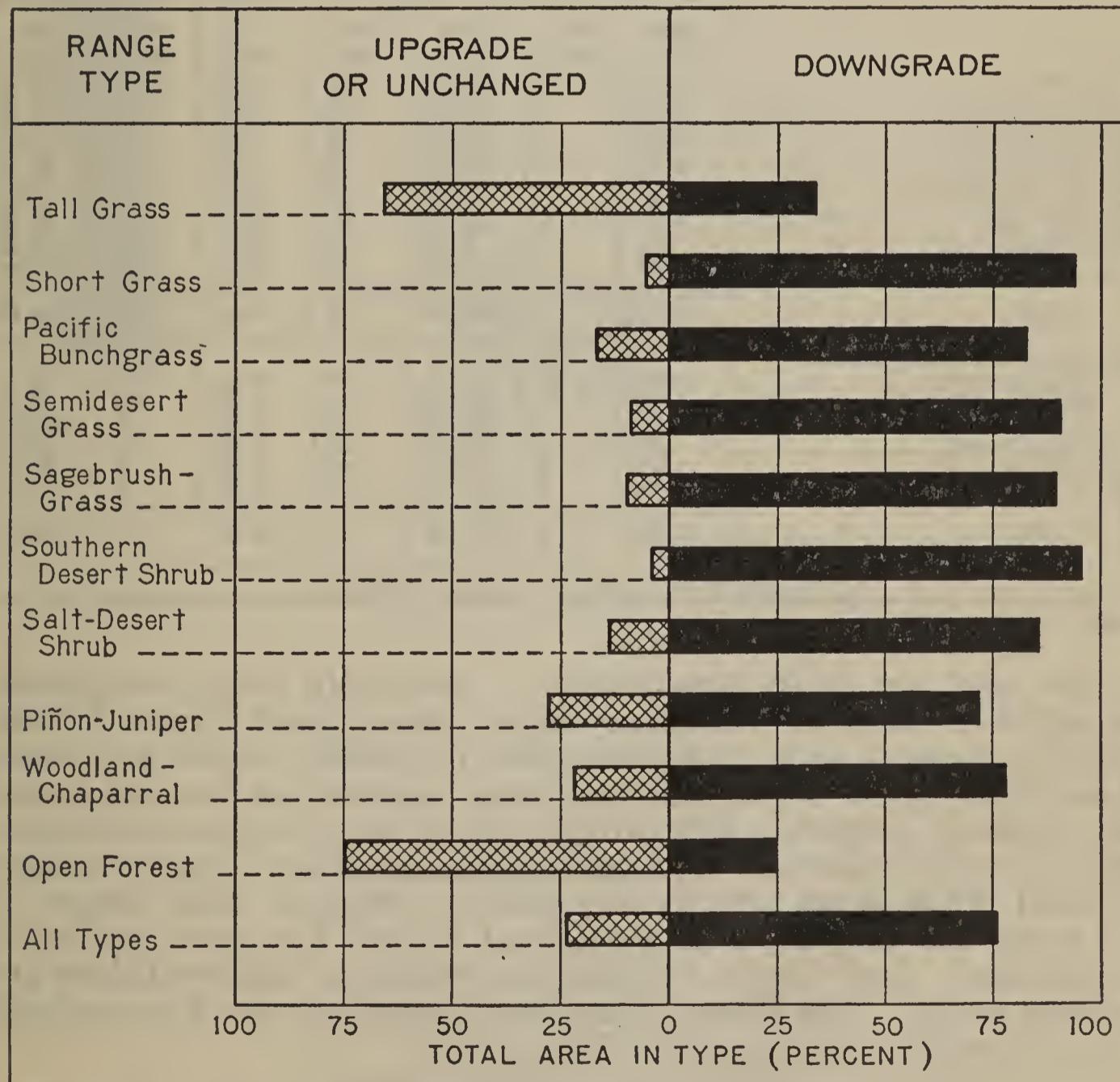


FIGURE 42.—THIRTY-YEAR TRENDS IN THE DIFFERENT RANGE TYPES.

Over a large portion of the vigorous tall-grass type, and also in the open forest, half of which is under national-forest management, forage values are improving or at least stationary. Downward trends in the greater part of the other types reflect mainly the results of unrestrained use.

More recently (table 25), these proportions have changed for the national forests. It is estimated that only about 50 percent of the national-forest ranges are continuing to improve, although further forage depletion has been stopped on about 32 percent of the total area of national-forest ranges. The reason for this recent change can be traced directly to the increase in number of livestock permitted on the national forests during the World War, aggravated by the recent exceptionally dry years. For various reasons, which will be explained in a later chapter, it has not been possible to reduce the number of livestock using these ranges to limits which officials know to be necessary to preserve the forage. The recent droughts, coming at a time when the range was overstocked even for normal years, caused a still further decline in forage values. No appreciable changes in forage depletion trends have been noted for other ownerships, since these (as shown in tables 24 and 25) already were 85 percent or more on the downgrade.

TABLE 25.—*Trends in range forage depletion for approximate period 1930-35*

Type or ownership(or control)	Appreciable improvement in forage ¹		Appreciable decline in forage		Forage conditions more or less unchanged		Total area
	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres
Tall grass-----	1,000 acres	Percent	1,000 acres	Percent	1,000 acres	Percent	1,000 acres
202	1	16,767	91	1,544	8	18,513	
Short grass-----	2,860	2	186,907	94	8,325	4	198,092
Pacific bunchgrass-----	1,068	3	34,666	81	6,800	16	42,534
Semidesert grass-----	1,746	2	82,002	92	5,526	6	89,274
Sagebrush-grass-----	2,670	3	88,769	92	5,089	5	96,528
Southern desert shrub-----	130	1	21,357	79	5,409	20	26,896
Salt-desert shrub-----	430	1	38,356	94	2,072	5	40,858
Pinon-juniper-----	7,385	10	55,872	74	12,471	16	75,728
Woodland-chaparral-----	844	6	9,080	68	3,482	26	13,406
Open forests-----	45,860	36	42,990	34	37,517	30	126,367
Total-----	63,195	9	576,766	79	88,235	12	728,196
Federal ownership and control:							
National forests-----	42,894	49	16,821	19	28,239	32	87,954
Indian lands-----	1,953	4	36,760	76	9,678	20	48,391
Public domain—grazing districts-----	1,255	1	118,673	93	7,864	6	127,792
Other Federal-----	568	2	18,360	80	4,069	18	22,997
State and county-----	1,969	3	58,961	90	4,586	7	65,516
Private-----	14,556	4	327,191	87	33,799	9	375,546
Total-----	63,195	9	576,766	79	88,235	12	728,196

¹ Includes also those areas in satisfactory condition at beginning of period which are unchanged in condition.

The need for range management is gradually being recognized. Regulation similar to that practiced on the national forests for the past 30 years is being put into effect on Indian lands, and more recently, a part of the unreserved public domain has been organized into grazing districts. But prompt action on a larger, much more decisive scale is needed to prevent devastation of the forage resource. Several range types already are nearly worthless. The forage of all types has far less than its normal value. Forage depletion is widespread. And forage depletion is continuing: bad conditions are getting worse. The "Great American Desert" of the Forty-niners' fancy is rapidly becoming just that in fact.

